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The London ATALANTA

THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.1 January 1987

ACID RAIN

Its effects on the flora and fauna in and around London

Dr. Mike Ashmore

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Pollution is not a new problem in London. John Evelyn, writing in 1661, noted that "it is the horrid smoke which kills our bees and flowers abroad, suffering nothing in our gardens to bud, display themselves or ripen; so as our Anemonies and many other choycest Flowers will by no Industry be made to blow in London or the precincts of it", and later compared the atmosphere of London with "the face rather of Mount Etna, the Court of Vulcan, Stromboli or the Suburbs of Hell". Even earlier, in the 13th century, Edward I was issuing royal proclamations against the burning of coal because of its polluting effects.

The concentrations of smoke and sulphur dioxide in central London probably peaked in the latter half of the last century. The city was much smaller then, with a great density of dwellings. Once the city expanded, and population density began to fall, the pollutants were spread over a wider area, and their concentration in the centre of the city fell. However, the most dramatic reduction in the levels of smoke and sulphur dioxide has occurred in the thirty years since the passage of the Clean Air Act of 1956. This Act was itself a direct consequence of the terrible London smog of 1952, at the peak of which an estimated 500 additional deaths were recorded each day.

These smogs are now a thing of the past, and levels of smoke and sulphur dioxide in London are now at a level which most experts consider presents no threat to human health. Yet the past five years have seen a dramatic increase in concern over the effects of pollution, in the form of 'acid rain' on lakes, forests and historical buildings. What is the cause of this concern, and what implications does it have for the flora and fauna of London?

Firstly, it is necessary to realise that the nature of the pollutants in our atmosphere, and the source of them, has changed dramatically in the past thirty years. What is referred to in the media as 'acid rain' is in fact a complex mix of chemicals. These include the actual rain polluted by sulphate and nitrate ions and also gases such as sulphur dioxide, nitrogen oxides and ozone; this mix is the result of a complex series of chemical reactions in the atmosphere from the pollutants emitted originally. There have been two major changes in the sources of these pollutants. The amount of sulphur dioxide produced from domestic fires and small factories has dramatically decreased, but the amount emitted by large coal or oil fired power stations has increased as a result of the increased demand for electricity. These large power stations are typically fitted with tall stacks, resulting in the pollutants being dispersed over a much wider area. The second change, which is much more important from London's point of view, is the rise of a major new source of pollution - the motor vehicle.

Traffic densities and vehicle numbers on the streets of London are now far greater than thirty years ago. These vehicles have been the main contributors to the large increase in the emissions of nitrogen oxides over that time. Furthermore, their emissions are mainly responsible for the production of ozone, which is formed in high concentrations in hot sunny weather.

The 'traditional' pollutants - smoke and sulphur dioxide - had many effects on vegetation in London; the disappearance of lichens and the impossibility of growing almost all evergreen trees being two of the most well-known examples. The effect of typical urban pollution was demonstrated experimentally in classic early work in the city of Leeds around the time of the first world war, in which the performance of a range of plants at different distances from the city centre was examined. The results showed vastly reduced growth of species such as radishes, lettuce, cabbage, violets and wallflowers in the city centre compared with the outer suburbs, while other species could not survive the atmosphere of the inner city at all. Although we do not have similar experimental data for London at that time, there can be little doubt that similar effects would have been found.

There is some evidence that the fall in concentrations of smoke and sulphur dioxide has been beneficial to plant life. Some lichen species have begun to recolonise areas from which they had disappeared, and it is possible to grow a wider range of trees in the parks of central London. However, a number of experiments which our group at Imperial College has carried out in the past five years have shown that adverse effects of London's atmosphere can still be detected.

Some of this work has involved comparison of plant performance along a transect from central London to our field station at Ascot, 35 km west of London, growing plants in identical soils at each location. A comparison of tree seedling growth in London and Ascot showed that, although growth over two years of Scots pine and Lodgepole pine was similar at the two locations, that of Norway spruce and Sitka spruce was lower in London. Studies of crops such as peas, barley and spinach have shown growth steadily increases with increasing distance from London, while standard soils exposed for two years showed a greater leaching of key nutrients, possibly due to acid rain, closer to London.

While the results of such experiments are very interesting, it is impossible to be certain that one is measuring the effect of pollution and not some other difference between the environment of central London and that of the outer suburbs - temperature and humidity may, for instance, be very different. For this reason, we have carried out other experiments in which plants have been grown in experimental chambers ventilated either with London air or with air passed through a charcoal filter which removes the pollutant gases. It is thus possible to determine the effect of the difference in air quality. These experiments have often, although by no means always, shown an effect of filtration. For instance, work at Kew Gardens has shown that leaf fall from oak seedlings is faster in unfiltered air than in filtered air. At Kew and at Ascot we have seen visible leaf damage to clover and to peas in unfiltered, but not in filtered air, after episodes of high ozone concentrations, while the composition of grass/clover mixtures has been shown to switch in favour of the grass component in unfiltered air.

Finally, this type of experiment has shown that the current composition of London air may affect insects too. Experiments at the College site in South Kensington have shown that blackfly on broad bean plants grow much more quickly in unfiltered air than in filtered air. This is not a direct effect on the blackfly, for if they are reared on sachets of artificial diet no such effect is found. Instead, it appears that pollution can cause changes in leaf chemistry which make the plants a better quality food for the blackfly.

Thus, although levels of sulphur dioxide and smoke have fallen considerably the effects of London's atmosphere can still be detected. We believe that it is the increased pollution from motor vehicles which is primarily to blame. It is known that sulphur dioxide and nitrogen oxides when present together can act synergistically; i.e. the effect of the combination is greater than the sum of the effects of the individual pollutants. Furthermore, in the presence of ozone, the effect of the combination of gases may be even greater. The fact that we have observed visible leaf injury due to ozone on several plant species illustrates the importance of this gas in London's atmosphere. It is now the effects of nitrogen oxides and ozone (produced primarily either directly or indirectly from vehicle exhausts), acting in combination with the levels of sulphur dioxide which still exist, which are of greatest importance. The problems of pollution in London have not disappeared over the past thirty years - it is simply that the chemical form and the source of this pollution have changed.

Mike Ashmore
Dept. of Pure & Applied Biology
Imperial College of Science & Technology
Silwood Park, Ascot, Berkshire, SL5 7PY

LEPIDOPTERA and SYRPHIDAE in the LONDON AREA 1986

Colin Plant, Recorder

The late summer was cold, wet and windy for the second year running. Despite the weather, it was an excellent year for White Admirals, which spread across into Essex; elsewhere, Silver-washed Fritillaries were well represented although they appeared later than usual by up to three weeks. Work towards the Butterfly Atlas is progressing and publication is scheduled for late 1987. It is hoped to include a colour photograph of every species occurring in the London Area, preferably from living specimens, and contributions of top quality colour transparencies are invited. Regrettably, there will be no fees, but photographers will of course be given full credit for their work. Of moths, the emergence of some genera was very late, resulting in such normally early species as the Hebrew Character Orthosia gothica and the Early Grey Xylocampa areola being recorded as late as 26th June. The number of contributors of moth records remains fairly low, but the quality of the data received is generally excellent. The eventual aim is the production of distribution maps for London's moths, including - if possible - the micro-moths.

A working list of the hoverflies of the Society's area appeared in the London Naturalist No. 65 and three species were added in 1986. Distribution maps have been prepared from the available data for each species and it is hoped that a publication will result. Specimens for identification are always welcome.

C.W.Plant
14 West Road
Bishops Stortford
Hertfordshire, CM23 3QF

A VISIT TO TRING

After a productive career spanning fifty years, John Gould died in 1881 with 41 volumes of illustrated bird books to his credit. For a sight of these one must either scour the antiquarian bookshops and sale rooms, or visit Tring.

At the invitation of Dr Philip Burton and librarian Miss Anne Vale, the Section went to the Rothschild Museum at Tring Park on December 13th. One member of the party was heard to remark that in the USA Audubon's "Birds of America" is displayed impregnably behind glass and the pages turned once a month. Not so at Tring. On a series of island tables down the centre of the library a selection of books of such excellence, beauty, rarity and distinction as would fill even the most moderate bibliophile with incredulity and delight was laid out for our inspection. These were the results of the Golden Age of book production and ornithological illustration, with pages and pictures of a size such that all four volumes of "B.W.P." would barely cover them. The glass-fronted cases which lined the library held row upon row of such volumes, bound elegantly in leather, lettered in gold, preserved in conditions of controlled temperature and humidity. Such was the degree of our privilege that any might be taken out by request: Gould, Lilford, Dresser, Seebohm, Bewick, Shelley, Bowdler Sharpe et al - all were there.

From the delicate woodblocks of Thomas Bewick (c.1800) and the aquatint engravings of Audubon (1827-1838), ornithological illustration progressed to the heights with the development of lithography (surface printing from stone) in the half-century following its discovery in 1798. Lord Rothschild's priceless collection of books (see K.H.Hyatt in L.N.64:131) includes a unique volume of lithographic bird illustrations by the prolific Victorian artist J.G.Keulemans (1842-1912). For each illustration there is first the artist's original drawing, in black and white. Next comes the (almost indistinguishable) print-off from the lithographic stone; to be followed by the hand-coloured lithograph by the artist himself - this to be the model for the team of artists which would colour by hand the hundreds of similar print-offs which would be required. Inevitably, some variations can be detected by comparing examples of work from so many hands; but the wonder remains that mostly they were marvels of execution and even under a lens their exactitude and fidelity prevails. Members will have on their shelves the three volumes of Coward's "The Birds of the British Isles" (Warne 1920 - 1926); most of the illustrations are by Archibald Thorburn but 88 are from Keulemans.

The process of the hand-coloured lithograph was employed by Gould and his associates - Edward Lear, H.C.Richter, Joseph Wolf, William Hart and Gould's talented wife and mother of five children, Elisabeth - to illustrate their monumental studies of birds not only of Britain and Europe but Asia, New Guinea and Australia. Lear (later to achieve immortality with his nonsense rhymes) had already produced 42 hand-coloured lithographs in 1832 of parrots, and his dynamic illustrations of toucans have never been surpassed. Joseph Wolf, considered by many to have been the finest animal and bird painter of his time, was especially noted for his birds of prey; collectors of Collins' New Naturalist series will find a superb example of Wolf's artistry on plate 22 in "British Game" by Brian Vesey-Fitzgerald. This book is valuable for many other reproductions of the work of Gould and his near contemporaries, but perhaps the richest storehouse easily available to members is contained in Vols. 6 and 7 of the "Encyclopedia of Birds", published in weekly parts by Orbis (1979). To turn these pages is to be reminded of the magnificent originals which made such a lasting impression on those visiting the library at Tring.

C.B.A.

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Chairman (E. & E. Section): C.W.Plant, B.Sc., F.R.E.S., M.B.O.U.
Editor: C.B.Ashby, 31 Tudor Close, Cheam, Surrey, SM3 8QT

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The London ATALANTA

THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.2 March 1987

DRAGONFLIES IN THE LONDON AREA

Stephen Brooks

The present LNHS Odonata recording scheme has now been in operation for two years. In that time numerous records have been submitted and a large part of the London area, particularly in Kent and Essex, has already been investigated. However, a great deal still needs to be done and I will be glad to receive records from any part of the LNHS recording area. I am grateful to everyone who has sent in records, no matter how few or how common the species. Every record is vital if we are to build up a comprehensive picture of the status of dragonflies in the Capital.

From the records I have received so far it is possible to draw tentative conclusions about the distribution of Odonata within the survey area and, by comparing the results with Cynthia Longfield's survey of 1949, to see which species have declined or increased during the last 40 years. Longfield listed 26 species which were thought to be breeding within a 20-mile radius of St Paul's Cathedral in 1949, about 70% of the species resident in Britain.

Many of the species Longfield found commonly all over London are just as plentiful now. These are species which are common throughout southern England and which will colonise a wide range of aquatic habitats from small garden ponds, to lakes and canals and slow flowing rivers. *Ischnura elegans* (the blue-tailed damselfy) is very widespread, occurring on most waterbodies, even those which are slightly saline or polluted. *Enallagma cyathigerum* (the common blue damselfly) is also common but favours lakes, ponds and sluggish rivers which have open stretches of water. *Sympetrum striolatum* (the common darter) and *Aeshna cyanea* (the southern hawker) will readily breed in garden ponds. *Anax imperator* (the emperor dragonfly) while not as common as the preceding species, is still widespread and will breed in most of the larger lakes and canals in the London area.

A few species have become more common since 1949. *Aeshna mixta* (the migrant hawker) was considered scarce by Longfield and most of the British population was composed of migrants. However, in recent years, it has become established as a resident in this country and it is now widespread in London, breeding in most freshwater habitats. *Orthetrum cancellatum* (the black-tailed skimmer) is also more common now than 40 years ago. This is probably because of the increase in the number of flooded gravel pits, especially in the Colne Valley in west London. Males of the species establish territories around the shores of lakes, favouring areas devoid of vegetation, where they perch on the gravelly beach. They are, therefore, amongst the early colonisers of newly flooded gravel pits and tend to move on as the bankside vegetation becomes established.

Several species which were found to be uncommon by Longfield are still present today, although most are restricted to a few localities and are, therefore, threatened. Many are rare nationally. Some are restricted to the acid heaths in southwest London, such as *Sympetrum danae* (the black darter) and *Somatochlora metallica* (the brilliant emerald). Others will only breed in shady woodland ponds, such as *Cordulia aenea* (the downy emerald) or in shallow reedy ditches and ponds, such as *Lestes dryas* (the scarce emerald damselfly), which has been discovered on Rainham Marshes and is thus threatened by the recent development proposals, and *Sympetrum sanguineum* (the ruddy darter). *S. sanguineum* oviposits on the damp exposed mud around the edges of lakes which have extensive beds of reedmace or branched bur-reed. It is rare nationally, being restricted to southeast England, and the London area is one of its strongholds.

There are a few species which will only breed in flowing water. The commonest of these is *Calopteryx splendens* (the banded demoiselle), which occurs in most of the river systems in London. It will tolerate mild pollution so seems to have held its own since Longfield's survey. *Platycnemis pennipes* (the white-legged damselfly) is much more sensitive to pollutants and unsympathetic river management and this may be why it has become less common is the last 40 years. It is now apparently restricted to the River Roding (recently polluted by an insecticide spillage), the River Lea (currently threatened by dredging proposals), the River Wey and the River Mole.

Most of the species recorded as breeding in London by Longfield were still resident in 1986, although many have become more restricted. *Brachytron pratense* (the hairy dragonfly) and *Ceriagrion tenellum* (the small red damselfly) are now apparently extinct in the area. Several species are now known only from a few sites and it is, therefore, a priority that these localities are protected. Some nationally rare species occur within the London area so these should also be carefully protected.

Finally, I would ask any of you with dragonfly records to send them to me. I envisage the survey continuing for at least another three years so would urge you to look for dragonflies when you are out in the field or garden. Your records are vital if we are to conserve these beautiful insects and the aquatic habitats on which they depend.

S.J.Brooks
4 Nelson Road, London, N8 9RU

SNAILS AS INDICATORS OF ENVIRONMENTAL CHANGE

Fred Naggs

The Conchological Society has operated a mollusca recording scheme for many years. Although it is based on a 10 kM-square grid, maps of greater detail may be constructed of particular areas where sufficient records are available. There are surprisingly few records for the London Area and it would be of much interest if this could be improved. Snails exhibit a number of characteristics which make their study of especial value, and indeed colonies of particular species may occupy a very small area for hundreds of years. From their limited mobility, their presence in a given habitat is less likely to be a chance occurrence than with many other groups of animals. Much can also be learned about earlier habitats from the fossil record left by shells.

The value of mollusc records as indicators of environmental change is becoming increasingly apparent. For example, a survey of ponds in Richmond Park has shown a rapid decline in species diversity over the past ten years. The reasons for this are not yet known, but it is evident that further surveys of this kind in the London Area could be extremely valuable. Members are therefore invited to undertake simple snail surveys of restricted areas; even garden records are of interest. I shall be pleased to assist with identifications and to send a few survey cards to members willing to take part.

Dept. of Zoology
British Museum (Natural History)
Cromwell Road, London, SW7 5BD

EDITORIAL

As concert goers will confirm, there is no substitute for the live performance. With the full repertoire readily available in recorded form, discerning promenaders still queue in the rain for the real thing. Naturalists, equally discerning, and now with easier access to alternative sources of knowledge than ever before, still trudge through the rush-hour crowds to attend our evening meetings; there to share the experience of the live performance in the company of others and, by being part of a responsive audience, to ensure the evening's success. The thought has long been with us that members attending these meetings would welcome some means of keeping alive the information and enjoyment crammed into a fleeting couple of hours, and that those unable to attend would feel less deprived if an account of the proceedings could come their way. E. & E. Section therefore commenced the preparation and issue of meeting reports in 1984. These have been freely available as separates and there is reason to believe that they have been appreciated by members.

The appearance of the Section's new publication, The London Atalanta, will provide the means of presenting these reports and abstracts in a more convenient form. The page numbering of successive issues will be on-going, so that an index may be compiled at perhaps 100 pages. Our separates hitherto have been exercises in reporting but Dr. Mike Ashmore's article in our first issue (in January), on the effects of acid rain on the flora and fauna of the London Area, was the author's transcription of his lecture to the Section in October last year. Whenever possible we shall include reports of field meetings and contributions from our recorders.

We hope that this new venture will be popular with members and we look forward to receiving your comments, criticisms and suggestions for future development. The present issue is being generally distributed so that all members may have the opportunity to assess the publication and decide for themselves whether they wish to receive future issues. No.3 will be distributed at the General Meeting on 19th May, and No.4 at the Parmenter Lecture on 21st July. Members unable to attend these meetings and who would like to receive copies, gratis, are invited to write to the address given at the foot of this page. (Please write soon, so that we shall know how many to print). Those wishing to collect the complete set will be glad to know that the first issue is still available on request.

Entomology has been an abiding interest in the Society since the earliest days, and the Ecology Section joined with Entomology in 1975 after a separate existence of forty years. The combined section holds meetings on widely divergent subjects and our recorders are active in many fields of enquiry. It is not too late to look through your diaries for 1986 records and send them to the addresses given on pages 13 and 14 of the current Programme. Early spring is the ideal time to follow up the excellent progress made of late in recording the amphibians and reptiles of London. In 1987 it is hoped to extend the survey to the more outlying parts of the Society's recording area. A provisional atlas of reptile and amphibian distribution within twenty miles of St. Paul's is in course of preparation and our recorder, Tom Langton, will be pleased to hear from members willing to assist.

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THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.3 May 1987

BRITISH MUSEUM (NATURAL HISTORY)
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SPIDERS IN THE COUNTY OF LONDON

J. Edward Milner

Fifty species of spiders have been added to the list for the County of London during the last decade, about half of these in the last two years. One of the most interesting new finds has been Porrhomma campbelli, recorded now on Hampstead Heath but from less than twenty other localities in Britain. St. James's Park is the first known site in London for the small money spider Milleriana inerrans, a pioneer species of agricultural land. New records have come from Chiswick Eyot, Oxleas Wood and Camley Street Nature Reserve, including the notable small pink and black spider Ostearius melanopygius. An up-to-date list of all records for the County of London now stands at 208 species, compared with the 130 species listed by T. H. Savory and A. E. Le Gros in their paper on the Arachnida of London, published thirty years ago.

As Recorder I have made preliminary visits to various sites which have hitherto not been included in spider records, and have operated small pitfall traps throughout the year at Alexandra Park in Middlesex. Observations at Thames Wharf and in three woods in North London have contributed to wider ecological studies. If the finds of 1985 and 1986 are a guide there is a good chance that further species will be found; particularly as at least twenty additional species are known from sites just outside the boundary of the main study area. If members could please send me specimens found in leaf litter samples from parks and woodland in south London, these would be most welcome.

J.E.D.Milner
80 Weston Park, N8 9TB

CRYPTOZOIC ANIMALS OF ANCIENT PEDIGREE

A field meeting led by Dr Adrian Rundle on 21st March, 1987

THE great limes which for over 100 years have been the pride of the palace gardens at Hampton Court lay sawn and lifeless on the grass. Visitors paused to inspect the banks of crocuses, the first camellias, the precision planting of the replacement trees. In the park beyond, the herd of fallow deer loafed contentedly in the warm spring sunshine. Such tranquil scenes were greatly at variance with the life and death struggles being conducted unseen and unheard on every side, beneath our feet, in all the secluded byways of the soil and vegetation, by creatures of whose presence one may so easily be totally unaware; or, if aware, dismissive. To term these animals "cryptozoic" is to be entirely factual, for they do indeed live hidden lives. In the words of Prof. J. Arthur Thomson, they are "refugees that will not admit defeat, but keep themselves to themselves in the crevices of the world, there living penuriously in hidden ways and obscure circumstances".

Preferred habitats are moist and slightly alkaline, and our quest led us to the base of an old brick wall; here amongst the grass, under stones and pieces of wood, and in the first few inches of the underlying dark friable soil, thirty species were discovered. With the simplest of tools - a small trowel, coarse and fine mesh sieves and a hand lens - the secret presence of creatures whose ancestors have lived thus for hundreds of millions of years began to be revealed. As small mammals are to the vertebrate food-chain, so the 300 species of Collembola or springtails are to the hosts of carnivorous mites, spiders, ground beetles, pseudoscorpions and centipedes. The British centipedes are sightless but highly active and tactile, immobilising their prey with the poison from glands in their pincer-like false legs, easily seen with a lens. Such armoured vegetarian Isopods and Diplopods as the "pill-bug" Armadillidium vulgare and the spotted snake millipede Blaniulus guttulatus were but two out of a tally of ten, and the leader had thoughtfully provided the party with tubes so that these and others could be taken home for further examination. Near the Old Oak Pond the mounded soil-nests of the yellow meadow ant Lasius flavus lay thickly in the tussocky grass and provided shelter for Platyarthrus hoffmannseggi, an Isopod to be found commonly in such situations but almost nowhere else. Further arthropods were located at the end of the day amongst pieces of rotting wood and in damp leaf litter in a hollow stump. The leader's special skills had provided an appreciative party with an insight into a hidden and perhaps unsuspected world. CBA.

For the full list of species identified, please send SAE to the address on p.12.

THE ESSEX WAY

A field meeting led by Colin Plant on 9th May, 1987

TO WALK through the woods, glades and coppices of Epping Forest on a warm sunny day in May is to enjoy the English spring at its best. The songs of blackcaps and garden warblers, chiffchaffs and willow warblers, whitethroats and lesser whitethroats could be heard as our party of ten members and friends took an easterly route from Epping towards High Wood and Toot Hill. The males of orange-tip butterflies were frequent but butterflies generally, apart from green-veined whites, seemed scarce; whether due to the recent cold snap or to last year's unfavourable summer - who can tell? Moths included the brown long-horn N. swammerdamella, and beetles the carabids P. madidus and A. parallelepipedus; besides three species of water beetles in, of all places, a muddy puddle in the path. The recent presence of a fox was detected from its spoor, and of fallow deer by their prints. Those who were quick were in time to see a viviparous lizard as it disappeared into a tuft of grasses. There were opportunities to seek out and identify various flowering plants and to compare notes over a picnic lunch in Birching Coppice. All in all, an enjoyable outing with much of interest.

For the day's list of species, an SAE please to the leader at:
14 West Road, Bishop's Stortford, Herts. CM23 3QP.

LIFE IN BRITISH COASTAL WATERS

Linda Pitkin F.R.E.S.

Report of a lecture at Burlington House on 9th February, 1987.
In the chair: Michael Wilsdon Esq., President.

Those who do not themselves venture beneath the surface of the sea must surely envy those who do. No one these days is a stranger to the underwater world of the television cameras, but such vicarious pleasures leave one totally unprepared for the sight of a silvery shoal of pouting, life-size, on a screen seven feet square. In Linda Pitkin - biologist, scuba diver and photographer of rare perception - an attentive audience soon realised that here was a most able guide to the bizarre, colourful, familiar and unfamiliar life forms of the ocean depths.

Even in the clear waters off the rocky west coast of Britain, the full range of colours is discernible by natural light only near the surface, and the diver is soon in a world of muted greens and blues. Yet all the tints of the rainbow appear on the finished film - and one is left to speculate on the significance of the colours of the deep which are revealed to human vision only by the photographer's electronic flash. The diversity of the life of the benthos is well seen off the shores of the island of Lundy in the Bristol Channel, where certain Mediterranean forms reach into British waters. By contrast, St. Abb's Head in Berwickshire forms the southernmost limit of some characteristically northern species, and the underwater biologist soon becomes aware that different parts of the British coast support widely different faunas. The island of St. Kilda was seen from the air as it lay in the deep waters of the Atlantic, encircled by a white line of foam from the waves which lapped its rocky shore. Beneath the surface, down to depths of 100 feet, the clear blue sea was home to almost all the invertebrate orders; and a grey seal was caught by the camera as it swam close to investigate the human intruder in its underwater domain.

Every one of the brilliant slides which illustrated the lecture was of a quality unsurpassed. Various cold-water sponges were followed by ten species of sea anemones, some up to eight inches across when expanded. There were particularly effective shots of the filter-feeding plumose anemones and of the aptly-named jewell anemones, the tentacle tips of which shone brightly in different colours from the tentacles themselves. The artificial reef which is the ultimate destiny of a sunken ship soon becomes covered by countless benthic forms of life, their tentacles waving this way and that in the currents; the deep-water species not having the ability to withdraw as do those living within the rise and fall of the tides. At St. Abb's all the vertical walls and gullies are covered with the two forms, orange and white, of the alcyonarian known by the macabre name of dead man's fingers; each a colony of tiny individual polyps emerging delicately from a stem in the form of a flabby, fleshy hand.

The sunset cup corals which fill the sheltered crevices of the submerged rocks at Lundy were seen to be anemone-like and of great beauty, as were the feathery and fern-like colonies of various hydroids revealed by the lights in detailed close-ups. There was a memorable shot of a free swimming jelly-fish, trailing long transparent tentacles in a green sea; epitomising the ability of the modern day marine biologist to see and record the throbbing life of the deep in a way denied to earlier generations - which perforce made do with the formless and mangled remains brought up by nets and dredges. Next came mats of the colony-making "moss animals", the Bryozoa, feeding on the minute specks of matter caught up in the turbulence from their ciliated tentacles. The vast group of the Annelida was represented by one of its most elegant members, the peacock fan-worm, endlessly seeking to ingest the minutiae trapped by its orange "fan" set above a narrow tube.

With the marine crustaceans which provide omnivorous mankind with so many gastronomic delights we were on more familiar terms; here was a lobster, blue in life and formidable, a creature of ancient lineage, armour plated, with eyes on stalks. There were velvet swimming crabs, employing flattened hind limbs for locomotion, and seven-inch spider crabs which would be lucky to avoid ending their days on a restaurant table in France. A more telling symbiotic relationship could scarcely be imagined than the sight of a prosperous hermit crab, bearing on its borrowed whelk shell an expanded anemone of equal size; affording seemingly impregnable defences compared with the shore crabs, desperately vulnerable to ruthless predation by the gulls at low tide.

Of nudibranchs - molluscs without shells - the sea slugs may only be an inch or two long but many are dressed in such vivid hues that aposematic colouration, so essential a defence in many terrestrial forms of life, may find its counterpart here beneath the waves. These formidable creatures were seen partaking of their living meals, afforded by breadcrumb sponges, sea-squirts and even the venomous hydroids. The stinging nematocysts of the coelenterates are absorbed by the predacious sea slugs, and reappear at the tips of their brightly coloured dorsal processes, where they still sting. A shy, nocturnal octopus was seen as it searched for crabs, and waves of pulsating colour were captured on film as a cuttlefish adapted almost instantaneously to the new surroundings to which it had been disturbed. Star-fishes and sea-urchins were there in plenty, and the 13-armed sun star was seen devouring the abundant brittle-stars where they nestled so closely side by side as to cover the substrate. A plant-like feather star had anchored itself by the small limbs which distinguish it from the similar crinoids of Palaeozoic seas. Adult sea squirts, having abandoned the roving life of youth, had settled down to a benthic existence from which they never again would be released, having cemented themselves to rocks by processes of their body wall. There are many species of such tunicates, some solitary, some colonial, and all sustain their translucent bodies by filtering particles from the water.

From the tunicates or ascidians, with their chordate free-swimming larvae, it is but a short step to the vertebrates of the benthos: the blennies and butterfish, the sea scorpions and dragonets, which dwell on the sand of the ocean floor. We saw the wolf-fish, four feet in length, a giant relative of the blennies. The green eyes of soles shone like jewels - as they would never shine on the fishmonger's slab. Next, the males of pipe fishes, transvestite relatives of the sea horses, which bear long ventral pouches in which to carry the developing eggs; and there were conger eels - big, rapacious carnivores venturing forth from a favoured crevice which they would occupy for years. To appreciate to the full the life of the sea the diver must enter this alien habitat by night as well as by day, for it is at night that such predatory species as the dogfish and other elasmobranchs are on the prowl. By night and day the grotesque angler fish, part buried in the sand, further camouflaged by mottled colours and a fringe of mock seaweed around its mouth, dangles its lure on an erectile spine. To have seen the shot which followed, of a large angler fish in mid-water, its cavernous jaws wide agape, making straight for the photographer, was to have shared an unforgettable moment beneath the surface of a cold and forbidding sea.

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The London ATALANTA

HE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.4 July 1987

PROJECT WALLACE

An entomological expedition to Indonesia 1985

Dr. J. S. Noyes

Report of a lecture at Burlington House on 19 May 1987
In the chair: Michael Wilsdon Esq., President

"Situated in the very midst of an archipelago, and closely hemmed in on every side by islands teeming with varied forms of life.....Celebes presents us with a most striking example of the interest which attaches to the study of the geographical distribution of animals". Thus wrote Alfred Russel Wallace in 1880. Wallace (1823-1913), famous for his journeys in the Indo-Australian region, observed that animal species occurring in Borneo and to the west were for the most part absent east of Borneo, and it was evident that this region marked the transition zone between the faunas of S.E.Asia and Australasia. Celebes, now Sulawesi, was chosen by a working party of the Royal Entomological Society to be the site of its projected year-long expedition in 1985 to Indonesia. The expedition would commemorate the 150th anniversary of the founding of the Society and the 100th anniversary of the granting of the Royal Charter. It would play a valuable part in the designation of specific sites as reserves, and would provide scientific assistance to a third world country through an international team of specialists in many fields.

The province of north Sulawesi is an important source of agricultural products such as copra, cloves, sweet potatoes, nutmeg and rice. The expedition was to be situated in the Dumoga-Bone National Park, consisting of nearly 300,000 hectares of tropical rain forest, the catchment area for an essential irrigation scheme utilising the waters of the Dumoga and Bone rivers. By early 1983 applications for participation were invited from entomologists worldwide who, in return for a substantial contribution to the costs of the expedition, would be accommodated in a well-equipped base camp affording ready access to both primary rain forest and selected agricultural areas. The expedition, which would cover a full year's climatic and vegetational cycle, would have five main objectives:

a) Agricultural entomology: to investigate the effects on agriculture and forestry of indigenous pests, and assess the interrelationship of pests, parasites and predators. A guide for local use would be produced.

b) Medical entomology: insects are known to be vectors of such diseases as typhus and dengue fever in Malaysia and Indonesia. Mosquitoes, flies, lice, ticks and other carriers of parasites and viruses would be surveyed in relation to human health and water supplies.

c) The entomology of forest regeneration: high on the list of the world's problems is the destruction of rain forest throughout the tropics, and in S. E. Asia much of it will have disappeared within the next twenty years. The adverse effect on the wellbeing of mankind is universally acknowledged but, in the words of Dr. A. G. Marshall, "we currently know remarkably little about the functioning of this, the most complex ecosystem the world has ever seen". Besides acting as pollinators, insects in their teeming billions are major agents of decomposition and of foliage, seed and seedling control; and are themselves the staple of many of the forest vertebrates. The expedition would investigate the role of insects in the natural cycling of the forest and its regeneration after disturbance.

d) Insect diversity: more than 80% of the known animal species of the world are insects, and it is believed that countless thousands of insects remain to be discovered. Of these, most are likely to be resident in the rain forests of the tropics and may vanish for ever under the onslaught of saws and tractors. The preparation of an inventory of insects in the Dumoga-Bone watershed would assist comparative studies with other parts of S. E. Asia.

e) A geophysical survey: effective site management and conservation requires detailed knowledge of both topography and climate, and the exploration of the headwaters of the two main rivers was to be an essential part of the programme. The volcanic and limestone mountains of the interior would be an important influence on rainfall and weather.

Dr. Noyes outlined his part in the venture and showed his two films of the daily life of the expedition. Specialising in the Hymenoptera, the speaker had participated in the collection of nearly 2000 species of this order, the majority new to science. Collecting of all insect orders by expedition members in the course of the year amassed the vast total of 50 million specimens of some 20,000 species, now housed in 82 cubic feet of cupboard space at South Kensington and likely to provide scope for taxonomic and other research for a decade or more. Collecting methods naturally varied according to the quarry. Lepidopterists were seen examining an illuminated sheet so covered with moths that the main problem must have been that of selection. Out in the forest by day, expedition members were seen at work with large beating trays and long-handled nets. The butterflies of these regions are legendary and there was a particularly effective sequence of 30 or 40 tropical swallowtails, their wings held aloft like sails, feeding delicately on the salts on drying sand at the river's margin. Other orders were collected by the use of baits and pitfall traps, by Malaise traps, and by shallow funnel-type traps hanging like giant dishes at various heights from just above ground to high in the forest canopy. Fieldwork was undertaken at distances of up to 60 km from base camp with the aid of a motor caravan. A forest bungalow and other temporary shelters were at the disposal of the expedition, and when such comforts perforce gave way to hammocks in the forest, daily communication with base camp was maintained by radio. Mostly the days were cloudy and often the mangrove swamps and afforested mountain sides were lashed by heavy rain.

Five well-attended courses on entomology for Indonesian students were run by the expedition. The speaker paid tribute to the committee of the Royal Entomological Society under the chairmanship of Dr. W. J. Knight, to the expedition's sponsors, and to the British armed services who provided invaluable logistical support. The Society is holding a symposium in September 1988 so that some of the expedition's 102 scientists may present and discuss their results to date. In all orders, many of the insect species collected - perhaps most - are hitherto undescribed. As Wallace had written in 1880, "we behold here the curious phenomenon of groups of insects changing their outline in a similar manner when compared with those of surrounding islands....."

BEHIND THE SCENES AT THE ROTHSCHILD MUSEUM
Tring Park

THE BIRD ROOM and its collections moved in 1971 from the Natural History Museum in London to a new purpose-built extension at Tring. The transfer of one and a half million bird skins into specially designed cabinets had been long overdue, as for thirty-one years they had been housed "temporarily" in the Entomology Department at South Kensington. The entomological collections at Tring, and especially the important collections of Lepidoptera bequeathed by the late Lord Rothschild, could now be transferred to become part of the national collection in London.

The programme of taxonomic research for which Tring has built up an international reputation is made possible by its comprehensive bird collection, one of the finest in the world. Occupying a space the size of a tennis court, row after row of floor to ceiling cabinets accommodate pull-out trays packed with specimens, each with its detailed data label, and all readily accessible for examination and study. The Society was invited by Dr. Philip Burton, field ornithologist, author, artist and Principal Scientific Officer, to go behind the scenes at Tring on December 13th last. Members who attended will recall with pleasure this tour of the collection under his expert guidance. The drawers containing the waders and the birds of prey were seen and were typical of the whole in affording the opportunity to relate field experience to the bird in the hand; and to demonstrate the value of reference material in establishing the often subtle differences between similar forms. An observer may spend a lifetime in the field and never see a gynandromorph, but sexual mosaics occur in birds as in other orders and there were some remarkable examples in the collection. The wide, deep drawers containing birds of paradise, resplendent in their extravagant plumages, included many specimens "collected" for the nation by the officers of H. M. Customs in their stand against a highly undesirable trade.

Of African birds, and particularly the birds of South-west Africa, the scientific work undertaken at the museum has added greatly to the knowledge of speciation in that continent. Separate studies of the world's crows and pigeons have resulted in the well-known textbook monographs by Derek Goodwin, and research into the biology and systematics of the cotingas, manakins and other South American fruit-eating birds has seen publication in Dr. David Snow's "The Web of Adaptation; Bird Studies in the American Tropics" (Collins 1976). Feeding studies have involved anatomical work based on the collections, leading to the discovery of hitherto unsuspected ways of life and evolutionary trends in families as diverse as kingfishers, rollers, woodpeckers and barbets. The B. O. U. expedition to Mauritius and Reunion in the Mascarene Islands has produced for the collection valuable sub-fossil material, and studies of fossil birds in Britain featured in a lecture to the Society by C.J.O.Harrison on Ice Age birds of the Lower Eocene, later published in The London Naturalist (1984: 63). Anatomical studies allied to field work have played an important part in analysing the sounds produced by crossbills and redpolls.

The collection includes many anatomical preparations preserved in alcohol and selectively stained to enhance their salient features. For investigations into bird evolution both anatomical and osteological preparations are of the greatest value. The museum has improved on the time-honoured method of obtaining a skeleton by exposing the body to ever-hungry ants, and has set aside a sealed room for use as a "dermestarium". Here, hordes of *Dermestes* beetles are cultured in escape-proof chambers and will produce a clean skeleton in a day. Research into any aspect of biological endeavour is a long and many-faceted process, and the use of the collections at Tring is often an indispensable aid to the evaluation of observations and experiments in the field. The skills of field ornithologists and the improvements in their optical aids are overcoming many of the obstacles to the identification of the living bird, and the gun is no longer the sole arbiter in the more problematical determinations. But, as members had clearly seen for themselves, the national collections continue to have an important part to play in the study of the lives, habits and evolution of birds, as of other animals. KHH, CBA.

The drawing of a Sicklebill *Falculea palliata* is by Philip Burton.

Back numbers: in our second issue, in March 1987, we mentioned that before the advent of The London Atalanta the reports of E. & E. lectures were in the form of separates. Those listed below are still available and we shall be pleased to send copies on request.

The Freshwater Fishes of British Waters; Charles Landells

The Dragonflies and Damselflies of Essex; Edward Benton

Recent Changes in the Butterfly Fauna of London and the South-east: P.A.Sokoloff, M.Sc., M.I.Biol., F.R.E.S.

The Wildlife and Countryside Act 1981; Dr. Michael Ford

The Ecology of an Essex Chalk-pit; Rev. David Agassiz, M.A.

An Introduction to the Ecology of Coastal Marshlands; Dr. D.H.Dalby, Ph.D., F.L.S., M.I.Biol.

Microscopy: A.P.Saunders-Davies and J.A.Dutton

Twenty-five Years in and about a London Garden; R.W.J.Uffen, M.Sc., F.R.E.S.

Epping Forest - the Ecology and Future of an Ancient Woodland; Paul Moxey, F.L.S.

The Biology and Ecology of British Butterflies; K.J.Willmott

The Ecology and Control of the Brown-tail Moth; Philip Sterling, B.A., F.R.E.S.

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THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.5 September 1987

MORE ABOUT DRAGONFLIES AT BOOKHAM COMMON - July 1985 to August 1987

a brief outline from Ruth Day

During the very wet summer of 1985 I started a population study of the dragonflies at Bookham Common as a third year undergraduate project, using a capture/mark/recapture technique. I very soon discovered that it was easy enough to catch damselflies in reasonable numbers with a butterfly net, mark their wings with a spirit-based marker pen and release them unharmed for later recapture - and quite impossible to do so with the bigger hawker and darter dragonflies. These can be caught by stealth and low cunning, but they never show up together in large enough numbers to be measurable by this method. The weather didn't help. When it is warm dry and sunny male dragonflies and damselflies can be found at the water's edge hoping to mate . If it is wet or overcast, they go away and hide. Two of the ponds at Bookham Common, Lower Eastern Pond and South East Pond, (See map at Fig.1) had been extensively managed in 1976/77 and therefore now had the most dragonflies. Accordingly I concentrated most on these two ponds, following up my initial 1985 project with shorter surveys in the two subsequent years. Netting for larvae and searching the reedbeds for empty larval skins (exuviae) showed that the Southern Hawker dragonfly *Aeshna cyanea* bred in some numbers in my two main study ponds. There were also a few at Sheepbell pond where there was a small population of the commonest Bookham species, the Azure damselfly *Coenagrion puella*, and a tiny population of the large red damselfly *Pyrrhosoma nymphula*, now the only site for this species on the Common. From Begon (1979) I selected Jolly's Stochastic method to process my field data because (i) it did not require consecutive samples

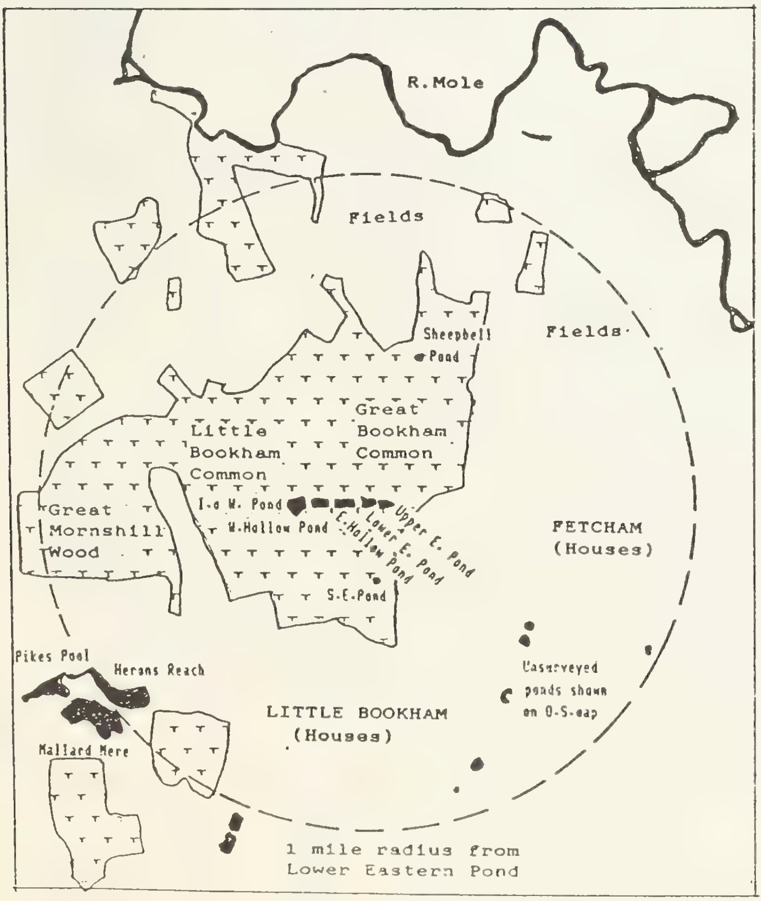

Fig.1 Bookham Common showing woodlands and waterbodies

necessarily to be taken on consecutive days and (ii) it did not depend on very large samples. My results over three years are shown in bar chart form in Figs 2 to 4 opposite. Daily catches of C.puella at either pond varied from 17 on overcast days to 60 on sunny ones. These fluctuations depending on weather are reflected in the marked differences in population estimates between consecutive occasions in the same year.

In 1985, there were around 200 male azure damselflies at both Lower Eastern and South East ponds. Emerald damselflies Lestes sponsa occurred in both sites, but only in ones and twos.

In 1986,South East Pond was not surveyed. There were around 400 azures at Lower Eastern Pond and 300 emeralds. Where had the emeralds come from?

This year,there are approximately 400 azures at South East Pond and only a couple of emeralds. There are 200 azures at Lower Eastern Pond and 150 emeralds. Why the difference?

I doubt if immigration is very important. In 1985, only 2 marked azures moved the short distance (c.300 m.) from Lower Eastern to South East Pond and it took them over a week to do so. The average adult lifespan is 4 weeks (Day,in press). The blue damselfly Enallagma cyathigerum and the blue tailed Ischnura elegans are the most common species on the large meres to the SW of the common. The blue occurs and the blue tailed is abundant along the R.Mole Small numbers of both are found at Lower Eastern Pond, but though the habitat seems to be within their ecological range, it is apparently far less than ideal, possibly because of vigorous competition from better adapted species. The large red occurs on the R.Mole, but it has not penetrated the common further than Sheepbell Pond.

Unlike the neighbouring water bodies so far visited, Bookham Common ponds seem to provide a habitat which favours the azure and emerald damselflies rather than the blue and blue tailed.

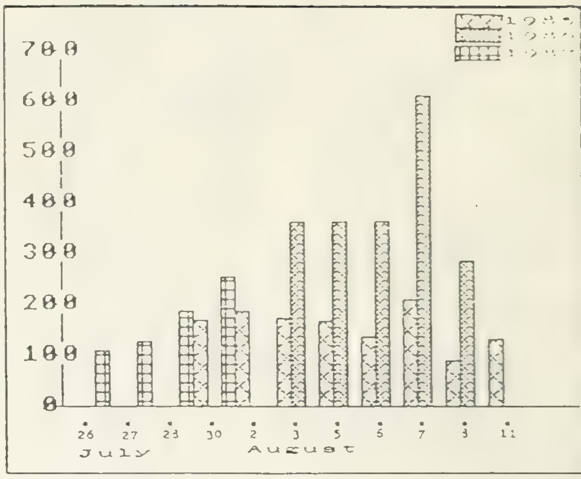

Fig.2 Population estimates of male azure damselflies at Lower Eastern Pond

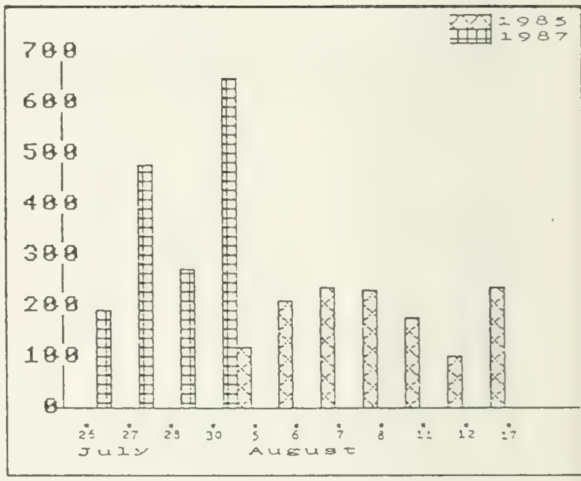

Fig.3 Population estimates of male azure damselflies at South East Pond

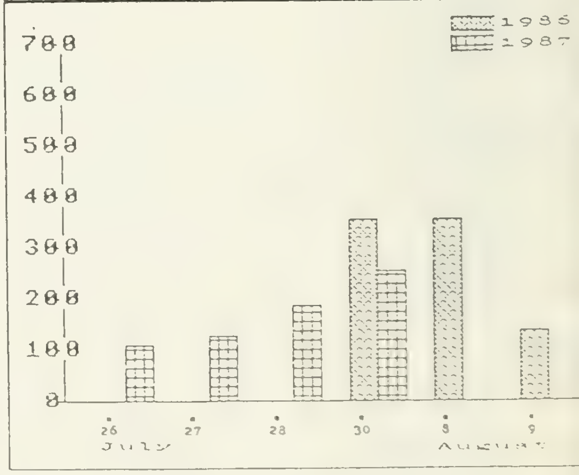

Fig 4. Population estimates of male emerald damselfies at Lowe Eastern Pond

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Two Surrey field meetings, led by Richard Goulding.

Park Downs at Chipstead and Farthing Downs at Coulsdon are two valuable and well-preserved remnants of the once extensive open downland south of Croydon. The earliest settlements on the dip slope of the chalk favoured the tops of the hills, but in a century of urbanisation it has been the dry, branching valleys which have mainly been given over to houses and gardens. A capping of gravel and clay on the high ground provides for a rich downland flora and fauna, and members attending our field meeting to Park Downs on June 7th noted some 50 species of wild flowers peculiar to the chalk.

In the dense woodlands which clothe the slopes beech, ash and birch predominated in a species list of trees which stood at 25 by the end of the day. Butterflies were little in evidence, the day being cold and the season late, but a small heath and four green-veined whites were included in a varied insect list of several orders. Of birds, the most notable was a redstart, not infrequent in Surrey on passage but less often seen now in the nesting season.

If the weather had withheld its favours on June 7th, on July 19th it was even more unkind, and the 48 species of plants located on Farthing Downs were perforce viewed through driving rain. The pyramidal orchid and the common spotted orchid yet raised their heads above the sodden turf; but from these open, rain lashed heights - which on a good day offer a splendid view of tree-capped slopes rising to a 360° horizon - the party felt obliged to retreat early to shelter.

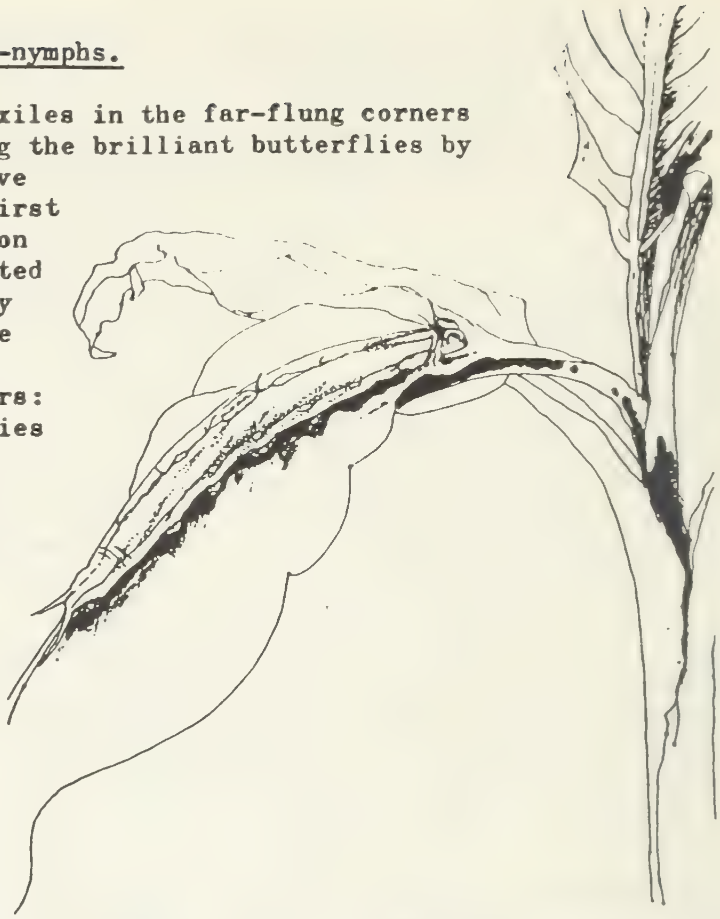
A field meeting on Bookham Common, led by Ruth Day.

This well-attended meeting was a sequel to the Parmenter Lecture given at Burlington House on July 21st and featured on pages 17 and 18 of this issue. In the course of six almost daily visits between July 25th and August 1st the leader had caught, marked and released unharmed 518 damselflies at Bookham. Also, 124 individuals were recaptured. To have handled, identified, sexed and noted nearly 650 living examples in so short a time may seem a formidable enough undertaking in itself, and yet was only part of an enquiry which is now in its third year and will extend to at least another.

The weather for our visit on August 2nd was far from ideal, being persistently overcast following heavy rain, but most of the regular species were seen; and also a male banded demoiselle, C.splendens, an infrequent visitor to still waters. The species which outnumbers all others at Bookham is C.puella, the aptly named azure damselfly. Marked examples of this and other species were recovered, providing the party with first hand evidence of the research in progress and adding to the interest and pleasure of the visit. South East Pond near the station, Sheepbell Pond in the N.E. corner and the line of four waters central to the common were visited. All are closely associated with trees, have a varying amount of emergent vegetation and water surfaces which may be clear or duckweed covered. To record and assess the fluctuating fortunes of the dragonfly and damselfly populations in this favoured Surrey locality, and to be ever aware of the possible links with variations in the habitat, might be thought to require a team effort. But Ruth has been conducting her research single handed, and our party was privileged to have been accorded this insight into her continuing achievement.

AN OPPORTUNITY to take a hand in the running of E. & E. Section will arise at the A.G.M. to be held on November 10th. Two vacancies exist on the Committee and members may offer themselves for election. The Committee meets on four evenings a year in central London to programme the activities of E. & E. in the months ahead. Members who feel able to contribute to the life of the Section in this way are invited to apply to the Secretary for a copy of the Minutes of a recent committee meeting.

Of postmen, mormons, owls and tree-nymphs.



It was inevitable that Victorian exiles in the far-flung corners of Empire should turn to collecting the brilliant butterflies by which they were surrounded, and give them fanciful English names as a first step in recognition. In the London Butterfly House at Syon Park, visited by the Section on August 29th, many butterflies whose names may be more familiar than their appearance are to be seen going about their affairs: courting, mating, holding territories and feeding from flowers and the juices of fermenting fruit. Notable among them are the cracker butterflies of the Caribbean. There can be nothing more surprising for the unsuspecting visitor than to hear a butterfly, of all creatures, emitting sound. Several, but not all, species of the nymphalid genus Hamadryas have this strange ability. As they launch out from their elevated resting places, where their upper sides are cryptic on lichened bark, and languidly fly to a feeding site they are silent. But let a tree-nymph stray into their territory, or a potential mate fly past, and they will go off in pursuit, to the accompaniment of a rapid sequence of sharp clicks like electric sparks, clearly audible to the dullest human ear. By what precise mechanism this sound is produced seems not to be known, but that it should be emitted at all must lead to the proposition that it is in some way received. Tympanic organs are found more in moths than in butterflies, and indeed Hamadryas is very moth-like as it rests in geometer fashion flat to the bark.

Our party was conducted by David Lees on a tour of simulated tropical glades, where up to fifty species of butterflies may be closely observed. The stock is not of wild caught origin but comes as pupae from butterfly farms in the tropics; or is home bred at Syon. A newly emerged Papilio polytes, the Common Mormon from Malaysia, had expanded its wings and soon would fly. The pupae of Euploea were as gilded hanging thimbles, owing their brilliant metallic sheen not to pigment but to an interference effect of the light. Pupae of Papilio clytia reproduced broken twigs and those of Caligo beltrao, the owl butterfly from Brazil, were in the form of rolled and withered leaves on which the veins showed clearly. The larva of beltrao on the leaf of a banana plant was kindly drawn for us from life by Peta Avery during our visit and adults were seen feeding and in flight. At Syon one may see butterflies in action: the ghostly forms of tree-nymphs from the Orient flutter and glide high among the leaves; postman butterflies from dense South American forests flaunt their warning colours with a shallow wing-beat; the blue peacock from Sri Lanka dances and hovers among the flower heads. A visit to Syon adds an extra dimension to the written word.

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THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.6 November 1987

THE WILDLIFE OF URBAN WETLANDS

W. G. TEAGLE

A report of a lecture to the Society at Holborn Library on 13th October, 1987
In the Chair: K.H.Hyatt Esq., Vice-President

The preservation and management of urban wetland habitats is a matter of concern for all who appreciate the variety of wildlife still living in close association with man. Such habitats may range from the industrial waterway of a major city to the narrow stream in a suburban park; from a back garden pond to a park lake; from a bricked conduit to a well-managed canal. The stark advice " Mussels should not be eaten " on a notice board beside the Firth of Forth told its own story, and was the first of many perceptive photographs shown by the speaker to drive home his message that much still remains to be done.

That much has in fact already been done to clean up the Nation's waterways and revitalise areas of neglect and decay was fully acknowledged both by word and illustration. The rehabilitation of the Thames is a history now well known to Londoners and we saw in retrospect the river in the afteryears of the war when there were no fish between Gravesend and Kew. The refuse barges at Hammersmith and Waterloo which attracted in the fifties gulls in their thousands for the pickings, and swan herds up to a hundred or more for the spillages, are no longer a part of the London scene. Now herons, cormorants and even shags have become common sights on the urban Thames since the return of the fish. The discharge of organic effluents into rivers as they flow through towns and cities is a food source readily exploited by wildfowl, as for example the flocks of scaup and goldeneye which are attracted in winter by the wastes from Scottish maltings and whisky distilleries. Where else but in Edinburgh may one have seen eiders from the top of a tram ?

London's achievement has become internationally known and is an example which authorities elsewhere in Britain, and indeed overseas, may follow. Shopping trollies in the tidal mud of a major urban waterway exemplify the all too common disregard of a natural amenity, and the Mersey as it flows through Liverpool is not alone in awaiting the implementation of the new awareness in conservation. Smaller rivers and narrow streams as they make their way through the built-up areas of Britain are in equal need of recognition, and their potential must be fully understood if their natural banks are not to be mistakenly replaced by bricks or concrete. Local authorities with responsible attitudes to the need to conserve and restore the urban wetlands under their control had often achieved conspicuous success, as could be seen from the excellent photographs which illustrated the lecture.

The riversides at Salisbury and Worcester were bright with meadowsweet and purple loosestrife. In Birmingham rivers still run between natural banks, affording refuge to such as water-voles and kingfishers. The canal at Walsall lies in a verdant setting where urbanisation is discretely tempered by a rich growth of sallow carr and emergent vegetation. The north-west arm of our own Brent Reservoir has been landscaped to provide a series of pools where the beds of flowering rush, reed-mace, sallows and willows relieve the starkness of the tower blocks which form the skyline. and support a breeding colony of reed-warblers within a few miles of the metropolis. The William Curtis Ecological Park, formerly at Tower Bridge, and the highly successful urban wetland created at Camley Street in Camden, have been of the greatest value in education. Other industrial wastelands at many sites in the West Midlands have been skilfully developed to form pools and marshes; examples of man and nature working together towards a result which is biologically to advantage and aesthetically beyond price. But the enlightened approach has been slow in coming, and photographs illustrated the demise of a fine urban lake and marsh in the south which had been senselessly destroyed within the last decade. The building of a road alongside Radipole Lake on the outskirts of Weymouth has signalled that even this famous site may not be secure.

Wildfowl and gulls are without doubt the most conspicuous creatures to exploit a waterway within the confines of a city. A town pool in Edinburgh was seen to be the refuge of a winter flock of fifty or more tufted ducks, and Londoners are fully aware of the influx in winter of wildfowl from northern Europe to the Serpentine and the lake in St. James's Park. Hand feeding by members of the public in London and other cities ensures that truly wild ducks, which would lift from their haunts in the north at the first sight of human approach, will compete fearlessly for scraps within a yard or two of the lunch-time crowds. W.H.Hudson, writing in 1898, was the first to report that black-headed gulls were taking food from the hand in London, and indeed it was then a practice of only recent origin. Previously, gulls had been mainly hard weather visitors to the Thames and parks, and prospered from a law of 1892 which prohibited the "discharge of fire-arms to the public danger".

The pictorial record of numerous sites was supplemented by portraits of the insects, birds and other creatures which live there. Every one of the many window ledges of a waterside warehouse in North Shields was seen to be occupied by nesting kittiwakes. The audience was stimulated to take part in a lively discussion afterwards and to add such snippets of information as that cormorants in St. James's Park supplement their diet with ducklings. The rapid colonisation of many wetland sites throughout Britain by the Himalayan balsam was seen as an unwelcome development by an introduced alien, now warranting urgent control.

A field meeting to the Black Pond, Esher Common, on September 12th.

The tall reeds bowed before the gusty wind and the willows showed alternately green and grey as we began our investigation of this favoured Surrey locality. Our party of fifteen members and friends was led by the Section's recorder for the Odonata, Stephen Brooks; a practical sequel to the lecture on dragonflies given by him two days previously on the occasion of our annual joint meeting with the British Entomological Society.

The Black Pond lies in an acid, tree-enshrouded, reed-lined depression in the damp heathland of Esher Common. The ever present sound of unseen traffic on the new highway was a reminder of the pressures which bear so heavily on such remnants of near-wilderness within easy reach of London. L.G.Payne, writing in The London Naturalist No.37 for 1957, listed the uncommon bush-cricket Metrioptera brachyptera from only a few sites in the London Area, of which one was Esher Common. Thirty years on, it is still there; a male and a female were located in dense vegetation between the pine woodlands and the reeds. The ever-increasing belt of Phragmites, and encroachment by numerous lusty seedlings of pine, plainly indicated the urgent need for management if the site is not to deteriorate within a very few years.

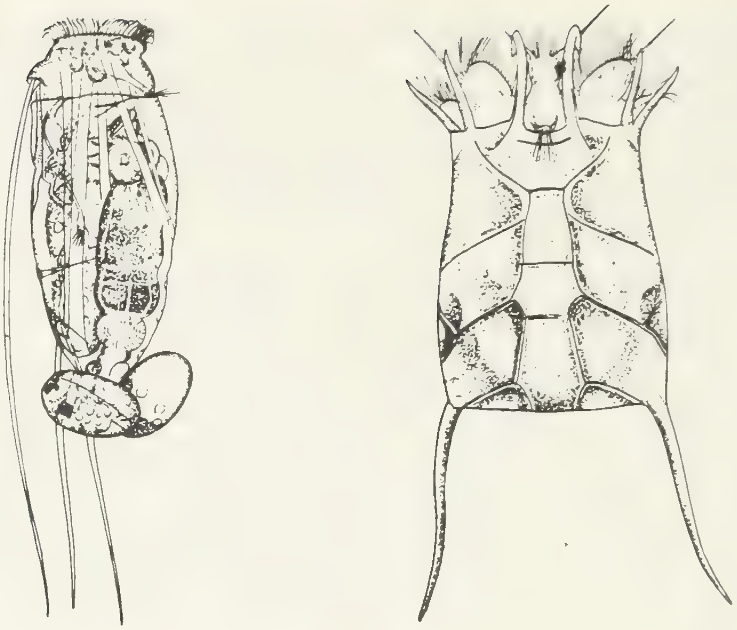
Dragonflies were to be the main quarry of the day and particularly Sympetrum danae, the Black Darter. This is mostly a northern species and is restricted in the London Area to the acid heaths of Surrey. Cynthia Longfield, in her often-quoted survey of 1948, gave the Black Pond as one of the few habitats of this distinctive species in the south, and it was therefore with some satisfaction that three or more were located during our visit; one even settling on the wrist of a member of the party and thus offering a cabinet view. Those seeing this species for the first time were probably surprised by its small size and neat appearance; the smallest of the true dragonflies in Britain. The site was sheltered from the main force of the wind, and the sun making one of its rare appearances led to the sighting of six species in quick succession.

Another Sympetrum, a red male of S. striolatum, was followed by Aeshna grandis and Aeshna mixta, the Migrant Hawker. Always a regular immigrant, but formerly scarce as a resident, this dragonfly now breeds in many fresh waters in lowland Britain. The aggressive males of the handsome blue damselfly Enallagma cyathigerum were now at the end of their season, but a few were seen. Botanists in the party found sundews in the sphagnum bogs and a good selection of the autumn fungi for which Esher Common is noted. As so often on field meetings, the diversity of skills and the sharing of knowledge had given everyone something to think about on the way home.

Microscopy at Bookham ponds.

All routes to Bookham on Sunday, October 18th were disfigured by broken and uprooted trees, it being but two days after the great storm. Members were relieved to find the Society's hut unharmed, but the common itself had not come through unscathed. Particularly in the direction of Mark Oak the damage to mature trees was severe. The lane to the hut, formerly impassable, had been cleared by the warden and his staff, and here as elsewhere large trees had been brought crashing to the ground even though many were deep in the woodlands. Electricity had not been restored to the hut or to the warden's cottage, and microscopists more used to turning on a switch to illuminate their instruments were obliged to adopt the methods of earlier times, and turn their microscope mirrors to the sky. Of sunshine there was fortunately no shortage, it being one of the most perfect of autumn days, notwithstanding that many of the delicate seasonal tints had been muted by the searing wind.

The patient anglers at the Isle of Wight Pond and Western Hollow paused from watching their red-tipped floats to cast a quizzical eye upon the proceedings. Our party produced fine-meshed nets, each terminating with a small flask, into which a rich haul of rotifers and other micro-organisms was swept by a forwards and backwards motion of the net in the sun-lit shallows. A weighted dredge was cast out and drawn in on a cord, sampling the fine silt from the bed of the pond. A variation in the collecting technique was provided by a small syringe attached to a staff, the draw stem being operated by a cord at various depths. The disciples of Izaac Walton unhooked their small, slippery carp and tossed them back to grow bigger; and expressed polite interest if not understanding when we explained the nature of our quest.



The rotifers *Filinia longiseta* and *Keratella quadrata*.
Drawn by E.D.Hollowday; from Garnett, *Freshwater Microscopy*. Constable, 1953

Our samples could be seen under the microscopes to be densely populated worlds in miniature. Micro-algae were represented by *Dinobryon*, the desmid *Closterium* and the long, green forms of the diatom *Synedra*; whilst other diatoms in profusion could be seen in ceaseless motion. Species of *Navicula*, *Pinnularia* and the elegantly sigmoid forms of *Gyrosigma* were microscopic photosynthesising plants in function, but animalcule-like in their gliding movements. L.V.Martin and fellow Quekett member A.P.Saunders-Davies provided specialist identification of some of the many rotifers present, including *Filinia longiseta*, *Keratella quadrata*, *K. cochlearia*, *Brachionus calcyflorous*, *Asplancha priodonta*, *Euchlanis dilatata* and a species of *Polyarthra*.

A giant among these active specks of life was *Stentor*, itself but 2 mm. in length, which performed extremely well for much of the day; extending its transparent trumpet-shaped form to its full extent and creating a miniature vortex from the rapid movement of its cilia. *Stentor* is a ciliated protistan, much more simple in body structure and organisation than the highly developed and multi-celled rotifers which were its smaller companions. David Walker was fortunate in finding an active brown hydra in one of his samples, and several species of *Cladocera*. A daphnia thought to be *D. longispina* was present, mainly females carrying five or six summer eggs visible through the transparent carapace. Females, usually with two eggs, were seen also of *Ceriodaphnia* sp.; others of the group included *Simocephalus vetulus* and the less common and very attractive species *Sida crystallina*.

Our return journey through the ravaged Surrey countryside was a sad ending to a field trip of much interest; but there would still be time for members to use their microscopes at home and observe the teeming forms of life in a thimbleful of pond water.

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Editor: C.B.Ashby, 31 Tudor Close, Cheam, Surrey, SM3 8QT

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The London ATALANTA

THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.7 January 1988

THE NATURALIST ON SCILLY

KEITH HYATT

An illustrated talk given before the Society at Holborn Library on 10th November 1987
In the Chair: R.V.Goulding Esq.

The Isles of Scilly lie some 28 miles WSW of Land's End. They are an extension of the line of granite bosses which start in the east with Dartmoor and decrease in height towards the west through Bodmin Moor, Hensbarrow Downs, Wendron Moors and Penwith. Of the 150 islands in the group, none is more than three miles wide and only the five largest, St Mary's, Tresco, St Martin's, Bryher and St Agnes, are inhabited. In legend the Scillies may be the Lost Land of Lyonesse, or perhaps the Cassiterides, from which the Phoenicians obtained their secret supplies of tin.

My interest in the islands was kindled in early 1957 when a group of members of the L.N.H.S. founded the St Agnes Bird Observatory, which ran for ten years and was soon established as a leading British bird station. Although the islands have been known as an outstanding area for birds for well over 100 years, no intensive birdwatching and recording had been done there prior to 1957. The St Agnes Bird Observatory published regular reports and when these ended the Cornwall Bird Watching and Preservation Society started publishing its own "Isles of Scilly Bird Report". To date over 370 bird species have been recorded from Scilly. Many of these are vagrants which arrive mainly during the autumn, and hordes of keen "twitchers" intent on adding a species or two - perhaps from the New World - to their life list are now a common sight in the islands in their season. It is also of much interest to watch the resident birds as, for example, the rock-pipits, stonechats and ringed plovers defending their territories. There will be non-breeding parties of whimbrels, and perhaps bar-tailed godwits and purple sandpipers. A rosefinch, more typically a bird of marshy thickets in Europe and Asia, made an unexpected appearance during my visit last year at the end of June. Despite heavy mists and a lack of good light, this splendid male sang daily from hedges bordering the bulb fields.

Botanising on these small offshore islands brings its own rewards, particularly as the equable nature of the Scillies climate permits such Mediterranean adventives as the three-cornered leak Allium triquetrum to prosper in shady places. The standard work on the wild flowers is "The Flora of the Isles of Scilly" by our late President, J.E.Lousley. Now out of print, a copy is in the L.N.H.S. library and contains a valuable bibliography. The islands are world-famous for their thriving cut-flower industry, especially the early daffodils for the Christmas markets. The Abbey Gardens on Tresco were founded in 1834 by Augustus Smith when he took up his appointment as Lord Proprietor of the islands on behalf of the Duchy of Cornwall. Snow is almost unknown, but the strong Atlantic winds which sweep over the islands required the provision of sturdy windbreaks, mainly of elm, sycamore, oak and poplar. These were supplanted by holm oaks and such other evergreens as Cupressus macrocarpa and the fast-growing Monterey pine. The development of the Gardens has received much attention from the popular botanical and horticultural journals and is well documented. Very considerable damage was sustained by the tender Pittosporum hedges and other vegetation of the islands during the severe and unprecedented frost in early 1987, when many notable shrubs and trees were killed. The older plants in the Gardens had become overgrown, and there is now an unexpected opportunity to replan and replant to advantage.

For those interested in visiting Scilly I would recommend the sea crossing from Penzance to St Mary's. As the Longships and Wolf Rock lighthouses fall away astern, there can be no better introduction to a spell of Atlantic life than the sight of dolphins and porpoises near the ship and the presence of fulmars, gannets, guillemots and Manx shearwaters. The seabird colonies on such uninhabited islands as Annet and Samson are protected during the nesting season, but may be closely observed from the sea. Regular boat tours of the bird islands under the guidance of William Wagstaffe, who may easily be contacted on St Mary's, are an excellent way of trying for the elusive roseate tern, and of obtaining an overall view of the islands and their treasures. Tresco, with its two large freshwater lakes, is quiet and good for waders. Gadwall may be seen there all the year. Bryher is rocky, with fine cliffs. The wild St Agnes has a low and varied coastline, and the Western Rocks beyond are the last for 3000 miles.

St Mary's is probably the most convenient island for the first-time visitor as it has plenty of accommodation and frequent boat services to all the main islands. There is a good example of a local museum on St Mary's, featuring not only natural history but Scillonian crafts and recoveries from the many shipwrecks claimed by the treacherous reefs in the approaches to the islands. St Mary's may be reached also by a light aeroplane service operated by the Steamship Company from St Just, on the Cornish mainland; and by a British Airways helicopter service from Penzance. This affords on a clear day a fine aerial view of the islands and their relation to each other from a modest height, and connects with services from Gatwick and Heathrow. I would be pleased to give any member further advice and recommendations for visiting these unspoilt, uncommercialised islands, where even such signs of the times as security barriers have not yet appeared on the counters of banks and post offices. Useful addresses are: The Isles of Scilly Steamship Co. Ltd., Quay Street, Penzance TR18 4BD (0736 62009), and the Isles of Scilly Tourist Board, St Mary's (0720 22049). You may be certain of a memorable visit to "The Friendly Isles".

Entomology in autumn - an exercise in observation.

When moth-hunters put away their lights and hang up their sugaring tins you may be sure that the onset of winter will not be long delayed; but for those versed in the ways of the micro-lepidoptera, and able to detect the tell-tale signs in fading leaves and fallen pine needles, there is fieldwork to be done in the last days of October. Our visit to the mixed woodlands at Broxbourne, Hertfordshire, on 31st October led to the discovery within a few hundred square meters of no less than 68 species of nine families of micro-moths; a very clear indication of the wealth of hidden life by which we are surrounded.

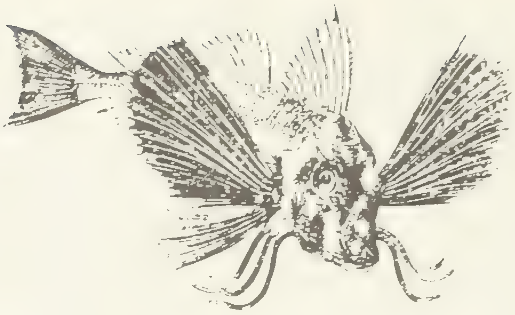
The Nepticule moths are a family of leaf-miners whose larvae dwell within the leaves of a variety of trees and shrubs. The feeding chambers, or "mines", formed by their daily progress within the leaf, conform to a pattern with characteristics of such constancy that the identity of the miner will usually be betrayed. With the assistance of the leader, Col. Maitland Emmett, the party was able to locate and identify, for example, the occupied mines of nineteen species of the genus Stigmella, all of which work their clear or whitish mines between the upper and lower epidermis of the leaf, leaving both intact. Up to three eggs are laid on a leaf and the position of the empty egg shells, together with the arrangement in lines or spirals of the larval frass within the leaf, provide for this group essential clues to the determination of the species. By contrast, the tiny larvae of the genus Phyllonorycter, in mining their way through the leaf, break into and consume either the upper or lower epidermis. The skin which remains then contracts and creases and the leaf becomes curled and is further pulled over by silken threads. Sixteen species of this distinctive genus were identified.

Another large group of these very small moths is represented by the family Coleophoridae, in which the larvae contrive portable habitations, known as cases, either from silk or from tiny fragments of leaves woven together. Close observation of the distinctive form and composition of these cases is the first step in identification, and the party named five species of the genus Coleophora found on plants as diverse as rose, rush and sallow. The onset of rain brought this productive meeting to an end, but not before a new record for the county had been achieved in the form of Tischeria angusticollella, mines of which were located in the leaves of rose. It is with pleasure that we accord our grateful thanks to Col. Emmett for sharing with us his unrivalled experience; and for ensuring the success of the meeting by an appraisal of the site a few days previously.

A visit to the tideway.

The ceaseless intake of large volumes of cooling water by industrial plants along the lower reaches of the Thames brings fish and invertebrates in countless thousands to the filter screens. Many perish, but escape channels are provided for those able to make their return to the river. Over one hundred species of marine and brackish water fish have now been recorded from waters which twenty-five years ago were lifeless after a century of pollution. This return to health of London's main waterway is fully described in The London Naturalist and other journals and has not gone un-noticed overseas. The Smithsonian, for example, carried an article in 1978 entitled "Father Thames has cleaned up his act, at long last". "The Thames Transformed" by Harrison and Grant in 1976, and Alwyne Wheeler's "The Tidal Thames" in 1979, made available to a wide readership the results of personal research and the essence of the many scientific papers and popular articles which had appeared. The return of bird-life could be observed; the return of invertebrates and fish was evaluated through a series of controlled sampling programmes. One such programme was based at the power station on the north bank of the Thames at West Thurrock, near Tilbury, where from 1967 onwards the catches at the intake screens showed a steady progression both in overall numbers and variety of species.

Through the kindness of Mr P.R.Luxton, Station Manager at West Thurrock, the Section made its third visit to the screens on 21st November. The leaders, LNHS members Karen Aston and Mike Andrews, had closely studied, together with D.G.Rickard and J.E.C.Steel, the recolonisation of the inner estuary between 1974 and 1981 (L.N. 61: 30-61). Of the seventy species of fishes recorded from this site, it was too much to expect that we would see them all in an isolated visit; but we were able to examine and record some hundreds of fish of nineteen species, some of them unfamiliar. The presence of smelt in our sample was a welcome indication of the continuing good quality of the water in the estuary. The smelt, a close relative of the salmon, increased at West Thurrock from ten per year on the screens between 1968-1973 to a thousand in an hour in November 1979. It is now a permanent resident in the river, and



fish in spawning condition have been found on the power station screens at Chelsea during the upstream migration in spring. The cessation of commercial herring fishing in the outer Thames estuary has led to the inner tideway becoming populated by large numbers of young fish up to 10 cms. in length during the autumn and winter. These, together with the related sprat, were included in our catch; as were small examples of the whiting. This is another species which spawns in the North Sea and for which impressive statistics are on record: eight per day at West Thurrock in 1971, rising to over 6000 in an hour in October 1977. A further gadoid species seen during our visit was the elegantly proportioned bib or pouting, first taken at West Thurrock in 1967 and now regular in winter.

The rocklings are bottom-living fish which appear only in very small numbers on the screens; we were fortunate to see one of these, the lesser forkbeard, known alternatively as the tadpole fish, an allusion to its appearance when young. The red gurnard, and its larger and less scarce relative the tub gurnard, were represented in the catch by half-grown examples 20-25 cms. in length. Both are deep water North Sea species with a history in the Thames dating only from 1967. The pogge or hook-nose, with a body encased in bony plates and of a remarkably prehistoric appearance, is a species mainly of the outer estuary and moves upriver in winter; two were seen. There was one example of the very much more infrequent "sea-scorpion" Taurulus bubalis, a spiny marine relative of the miller's thumb or bullhead; and several juveniles of the bass, another winter immigrant to the tideway.

From its position below the sewage treatment works at Beckton and Crossness, West Thurrock is well placed to monitor the tolerance by a wide diversity of species of the dissolved oxygen levels in the river. It has been demonstrated from sampling at West Thurrock that the recovery which began in 1964 took a sharp upturn from 1977 onwards, coincident with improvements at Beckton and the moderation of oxygen depletion associated with the discharge of organic effluents. At the time of our visit the station was drawing five million gallons an hour from a flooding tide, and although well below the peak rate this was sufficient to bring in a good assortment of flat fishes from the bed of the river. The flounder, having a high tolerance of reduced salinity and comparatively low oxygen levels, was among the first of the early re-colonists, and is now abundant in the Thames. Flounders were frequent in our samples, outnumbering the dab, plaice and sole, of all of which small juveniles were seen. As Wheeler (1979: 159) has pointed out, fish species which habitually form large shoals may occasionally be swept up in the intake current of a power station in such numbers as to falsify the impression of their overall abundance. Given that the catches need to be evaluated with such factors in mind, there can be no doubt that over the years the West Thurrock screens have provided invaluable evidence of the return of fish to the inner estuary. Our privileged visit on a bright, clear day had been of much interest; and it was a pleasure to meet again our cordial host, Mr Bill Steer, who had thoughtfully arranged refreshments in an upper floor refectory offering panoramic views of the river.

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The drawing of a tub gurnard is by courtesy of Alwyne Wheeler; Routledge 1979

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THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.8 March 1988

FORENSIC ENTOMOLOGY

Dr. Y. Z. ERZINCLIOGLU

A lecture given before the Society at Burlington House on 16th February 1988
In the Chair: R.V.Goulding Esq.

The application of the study of insects to the investigation of crime is now recognised as a source of reliable evidence. The proof of guilt, or indeed the proof of innocence, may depend upon an intimate knowledge of the life history and habits of an insect. A captain stood accused of committing murder on a day in September. Blowflies and others of their kind are no respecters of the human condition when selecting a site to lay their eggs, and the larvae found on the body were collected and identified. One dipterous maggot might reasonably be thought to be much like another, but the forensic investigator will detect the small differences between species in their first, second and third instars. The fly which proved the captain's innocence was found to be a species inactive after 6 p.m. in September, indicating that the crime must have occurred before that hour on the day in question or the day following. But the captain's movements before 6 p.m. were known and proven, and the age of the larvae - having been established beyond doubt - precluded the possibility of death having occurred the following day.

Close examination of the segments of a blowfly larva, the presence or absence of spines, even the microscopical examination of the mouthparts, will provide essential pointers to identification and age. The structural features of the first and second instars, often only of brief duration, are in some species diagnostic, but where doubt remains the larva is reared to the winged state. The size of the larva is often an unreliable guide to age and development. Much will depend on the microclimate associated with the site, deduced from basic meteorological data over the preceding days or weeks and adjusted for the degree of seclusion and cover. The speaker outlined a number of cases in which the entomological evidence had provided conclusive proof of guilt, and it was apparent that the essential link between all these investigations was the ability to observe and evaluate the arthropod fauna at the scene.

Forensic entomology is for the most part a twentieth century science. Its wider application may determine the origin and nature of food contamination and the source of drugs. A seized packet of cannabis is likely to include twenty or more identifiable species of arthropods widespread throughout the Far East. The forensic scientist will be less concerned with these than with the one or two species perhaps present in the sample which are of only limited distribution. As practised to-day, forensic entomology is the painstaking application of an in-depth knowledge of the characteristics, life histories, habits and distribution of a great many insects and allied orders in both hemispheres. A peasant farmer was found to have met an untimely end. The Chinese overseer brought together the harvesters of the district, young and old, each with his scythe, and bade them stand in the sunshine. To anticipate the science of to-day by a clear eight centuries was less his concern of the moment than to observe on whose scythe the flies were settling. An apocryphal story? Perhaps; but the evening had provided an informative introduction to a subject hitherto unsuspected, much less encountered, by many of those present.

SOME HAMPSTEAD LEPIDOPTERA IN 1987

R.A.Softly

Some of the micro-moths have produced unusual statistics at Hampstead in 1987. Three of these are members of the very large family of Tortricoid moths, of which there are over 300 species in Britain; and two are of the distinctive family known as the Incurvariidae, in some of which the males have very long antennae, exceeding the wing length two or three times. Whether my observations are representative of national or purely local fluctuations remains to be seen.

Since 1979 I have operated an actinic light trap continuously on my balcony bordering the southern edge of Hampstead Heath. Within sight from the balcony is a railway cutting covered largely in sycamores, and there is one large poplar. The tortrix Pseudargyrotoza conwagana Fabr. shows the biggest increase to light in 1987. I first identified it in 1981 when four appeared in the balcony trap, at tree-top height. I did not find it at light at all during the two subsequent years but had two in 1984, one in 1985 and again in 1986. By contrast, in 1987 no less than 30 appeared, ten of them on June 29. The extreme dates for all records since 1981 are June 11 to July 28, with one late example in 1987 on August 17.

Bradley, Tremewan and Smith, in British Tortricoid Moths, 1983, say it is seldom seen at light and this was hitherto true enough here. They say also that it flies from May and that on warm, sunny days it may be seen flying actively about the foodplants, particularly large ash trees. This I have not seen but in 1987 I did net this moth on three occasions on the Heath. Hampstead and the Heath has many mature ash trees, though none very close to the trap, and I assume that ash keys rather than privet berries, which are few and far between hereabouts, are the staple diet of the larvae.

Another tortrix, Argyrotaenia pulchellana Haw., is described by Bradley et al as occurring on heaths and moors. This will not explain its presence at Hampstead, except as a relict population, for the Heath has hardly any true heath left. They say it is a late afternoon flyer; I have seen it here only once by day, along the allotments further down the railway cutting. But it has occurred very sparingly at light since 1982, no more than three in a year. In 1987 there were seven in the balcony trap and sixteen in the adjacent ground-level trap, which has been run simultaneously since 1984. Looking at the list of non-heath food plants, I would guess that locally it is feeding on cultivated apple, on which it is recorded as a minor pest on the Continent. It is bivoltine at Hampstead, and 1987's light records show two in May and 21 from August 16 to September 2. Possibly anything up to a threefold variation in numbers is hardly worth remarking upon, but the 1987 second brood did seem to indicate a notable increase; and its occurrence in Hampstead at all indicates that it is not restricted to the typical habitat of "heaths and moors".

A third tortrix, Clepsis spectrana Treits., also had a sudden large second brood in 1987 when, after years of ones and twos at light, eleven appeared between August 20 and September 17. This is at distinct variance with Bradley et al, who refer to a "small second generation in August and September". The fen and marsh habitat required by the species is provided at Hampstead by the streams and ponds, and the spring line below the Bagshot sands, from which I have often reared it from the spun heads of Epilobium. The wet summer of 1987 may have accounted for the success of the second brood by prolonging the moist conditions of the spring. August examples have occurred in three previous years. This is a species never yet taken in the high balcony trap, all light records having been from ground level.

The longhorn Adela reaumurella Linn. normally delights the eye on Hampstead Heath as it flies in swarms in the May sunshine. Alas, all I saw of it in 1987 was a singleton on May 27. But another longhorn, Nemophora degeerella L., by contrast produced several swarms in mid-June. These swarms fly much lower than reaumurella. Strangely, it was only in 1986 that I met it on the Heath for the first time, as a single swarm; in 1987, I saw five swarms. This might suggest a successful new colonisation, though why this species should not have maintained a continuous and abundant population in such a habitat is a mystery. J.Heath and E.C.Pelham-Clinton, in MBGBI 1976, have said that it flies at dusk, but all the swarms seen by me were in sunshine, around mid-day. What is the experience of other observers?

Of noctuids, the dotted rustic Rhyacia simulans Hufn. apparently continues its increase in the south-east generally. Previously, I had recorded it at light on July 30 in 1980 and on September 22 in 1985. In 1987 it appeared on June 28 and September 11, 15 and 21. These dates match the statement, ibid., vol.9, 1979, that the moths emerge and fly in late June and early July, then aestivate and re-appear in late August and September. But how, I wonder, does the reported distribution "local on calcareous soils" fit these records?

An Essex field meeting on 6th December 1987.

To take a hand-lens to the sodden herbage and grassy tussocks in the bogs of Epping Forest after a frosty night might be thought a highly specialist activity; but for the spider hunter it is likely to be a most productive exercise even on a cold, grey, mid-winter day. With the guidance of Peter Harvey of the Essex Field Club, our party's diligent search resulted in a list of twenty-five spider species from the levels bordering Honey Lane; including the notable Enoplognatha thoracica and such other characteristic species of wet grass as Lophomma punctatum, Diplocephalus permixtus and Micrargus herbigradus. These could be examined in the comfort of the Epping Forest Conservation Centre at High Beach, where microscopes were at our disposal. Leaf litter samples from the surrounding woodlands were strewn on white sheeting, and the wealth of invertebrates thereby revealed ranged from such carnivorous arthropods as centipedes of several species to spiders of a further fifteen species; besides a challenging assortment of millipedes, woodlice, springtails and beetles. For a full list of the spiders recorded, please send an SAE to the leader at 9 Kent Road, Grays, Essex, RM17 6DE.

"The long overdue re-introduction of coppicing in some areas, thanks to the efforts of voluntary conservationists, has heralded a return of certain woodland species. Coppice woodlands are undoubtedly the best woodland butterfly habitats".

From the Society's new book, The Butterflies of the London Area by Colin Plant. Price £15.95, postage paid, from 14 West Road, Bishop's Stortford, CM23 3QP.

LONDON'S DRAGONFLIES

Stephen J. Brooks

From the lecture given before the Joint Meeting of the LNHS and the BENHS at 74 South Audley Street, W.1 on 10th September 1987

In the Chair: Professor J.A.Owen M.D., Ph.D., F.R.E.S.

The purpose of the LNHS Odonata recording scheme is to build up a picture of the dragonfly distribution within a 20 mile radius of St Paul's Cathedral. This will indicate which species are locally rare or common and exactly where they occur. This has direct relevance to the conservation of dragonflies in the Capital by indicating which sites support locally or nationally rare species or those harbouring large numbers of species.

Compared with other insects, Odonata are a good group to record because they are conspicuous, easy to identify using the field guides available, and they are a good indicator of water quality. Therefore, a minimum number of site visits gives a good indication of the dragonflies present. That the data is useful and in demand cannot be disputed since in the last year I have supplied information on several threatened sites, such as Rainham Marshes, New River and Osterley Park and also aided in survey work such as that being undertaken in Harrow and the London reservoirs. At present, data has been received from about 370 sites, representing about 33% of the LNHS area, and at the end of the 1988 season I hope to produce a provisional atlas and report for publication in the *London Naturalist*.

Dragonflies have an aquatic larval stage so water quality is one of the limiting factors governing their distribution. Without well-oxygenated, unpolluted water the larvae cannot survive. Plenty of submerged and emergent vegetation is also a basic requirement. The submerged plants introduce oxygen into the water, conceal the larvae from predators and provide a platform from which they ambush their prey. Such plants are also vital as emergence supports after the completion of larval metamorphosis and as oviposition sites. The close availability of mixed woodland and unimproved grassland to provide shelter and insect food for the adults will also improve the quality of a site.

Odonata recording has a long history in the London area with Leonard Plukenet (1642-1706) probably being the earliest. The most comprehensive survey of the area was that published by Longfield (1949) and it is with this that the current survey can be compared. All the species Longfield found to be common are still widely distributed with *Ischnura elegans* and *Aeshna grandis* probably being the most frequently encountered. *Aeshna mixta*, rare in Longfield's day, is now common in London but has increased its range throughout the east and midlands of England. *Orthetrum cancellatum* has also become more widespread in London possibly because of the increased number of gravel-pits. All of the rarer species appear to have held their own with the Surrey heathlands supporting the majority of the acid-loving species with restricted ditribution such as *Somatochlora metallica* and *Ceriagrion tenellum*. It is the running water species which seem to have fared worst with all but *Calopteryx splendens* becoming less common.

It is hoped LNHS members will continue to send me their dragonfly records which are vital if we are to ensure the conservation of these insects in the London area.

S.J.Brooks 4 Nelson Road, London, N8 9RU

Cynthia Longfield's paper is in The London Naturalist 28: 80-98.

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The London ATALANTA

THE NEWSLETTER OF THE L.N.H.S. ECOLOGY & ENTOMOLOGY SECTION — No.9 May 1988

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EVOLUTION IN CARNIVOROUS MAMMALS

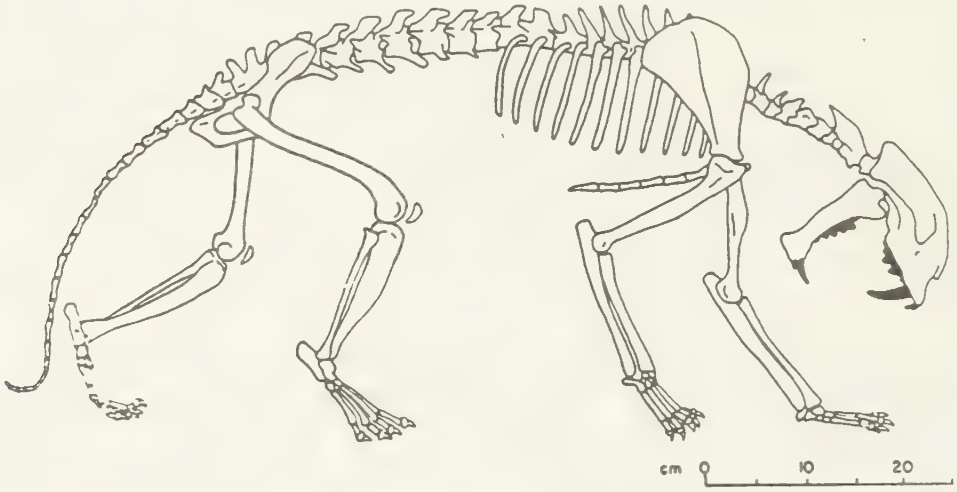
Professor R.J.G.Savage
University of Bristol

A lecture given before the Society at Burlington House on 5th January, 1988
In the Chair: R.V.Goulding Esq.

We see the lion as the king of beasts, the most superb example of carnivorous life, but most carnivores are the size of civets and stoats and their main diet is rodents. All share two essential carnivore qualities: a preference for a high proportion of meat - the flesh of other vertebrates - in the diet, and a dentition capable of cutting meat into swallowable chunks. For this, carnivores have evolved a specialised pair of carnassial teeth with sharp, shearing blades. Most also have well developed canine teeth: the curved, pointed, piercing teeth used in killing prey. Some have developed special dentitians, as have hyaenas with heavy premolar teeth for crushing bones and sea-otters with shell-crushing cheek teeth. The most famous dental stars were the sabre-tooth tigers, with greatly elongated canine teeth for deep stabbing.

The first carnivorous mammals evolved from insectivorous mammals in the early Cenozoic. They were mostly members of the now extinct order Creodonta, which produced forms similar to the later hyaenas, dogs, cats and bears. They lived in North America, Eurasia and Africa and survived until about 10 million years ago. The true carnivores probably appeared about the same time as the creodonts, and although slower in radiating were by mid-Tertiary times replacing the creodonts at an ever increasing rate. The third stream of carnivorous land mammals is to be found amongst the marsupials. In South America they were the only carnivorous mammals until the Pliocene, although they had competition from large carnivorous birds during their long period of isolation, and even produced a magnificent sabre-tooth tiger. In Australia the marsupials evolved carnivores which paralleled the placental cats, dogs and lions, of which only the cat, the Tasmanian devil, survives.

The term 'carnivore' as applied to a mode of living is not quite the same as the taxonomic order Carnivora. The predacious toothed whales are not of that order and are excluded from our study; they lack carnassial teeth and their major adaptations are to living in the oceans. Some members of the Carnivora have ceased to be carnivorous; for example, the giant panda, the ant-bear and the badger. The carnivorous mode of life is so demanding that it has an impact on all parts of the body. In a collection of fossil bones the carnivores are easily picked out. The backbone must be very pliable, able to move in virtually any direction; watch a kitten at play and see how it can almost tie itself in knots. The limbs must be able to fulfil many different functions: walking, crawling, fast running, climbing, digging, swimming, grabbing prey and tearing it with the claws. By contrast, a zebra simply has to move its legs to and fro, slowly or quickly. Thus we can interpret the adaptations in the vertebrae, limb bones, digits and claws to reveal the details of the carnivore's habits in life.



Restored skeleton of Dinictis; a sabre-tooth cat, the size of a modern serval cat, from the Oligocene of North America. (c.35 million years).

Acute sensory perception is vital to the meat-eaters. Many have a highly developed sense of smell which is of use to detect prey at a distance, but is reduced in such aquatic forms as otters and seals. Most have very good vision, and cats, dogs and hyaenas in particular have stereoscopic vision, which enables them to home in on a fast-moving target and aim their canine teeth accurately on the blood vessels in the neck. Hearing is especially well developed in desert carnivores, the dry, warm air being ideal for sound transmission. The brains of carnivores are proportionately larger than those in herbivores of similar size and are also more complex, with more folds in the cortical tissues, implying a higher intelligence. Most will agree that a dog is more intelligent than a sheep, and this carnivore/herbivore difference appears to have been maintained throughout Cenozoic time. Yet with all their skills in sensing which victim to attack, their alert brain and cautious approach to close quarters unseen, and the application of their well adapted body for the final rush upon the prey, the hunters often fail.

Life for carnivores is held in a precarious balance between survival and extinction. With the ever growing menace of the super-predator, man, many of our most wonderful and beautiful wild carnivores may soon join the long list of species now extinct.

Further reading: Mammal Evolution: an illustrated guide. R.J.G.Savage and M.R.Long. British Museum (Natural History); London, 1986. Reviewed in The London Naturalist 66:21.

STRAY NOTES ON LONDON'S MOTHS

Colin W. Plant

I had always intended, after publication of the butterflies, to prepare a revision of the work on London's moths by the late Baron Charles de Worms in The London Naturalist from 1953 to 1978. Mountains of written records have been accumulating since 1979, when I became Lepidoptera recorder for the Society, and these have been the basis of my biennial reviews to 1986: ibid., Nos. 60-66. I recently spent two weeks in mapping the data for macro moths from 1980-86, and found at the end that I had mapped in excess of 35,000 records for 526 species. These are shown in the following table, and are compared with de Worms' totals for all years up to his second Supplement (LN 39: 99).

	1980-86	de Worms to 1959	British total
Hepialidae	5	5	5
Cossidae	2	3	3
Zygaenidae	3	5	10
Sesiidae	8	12	15
Limacodidae	1	2	2
Lasiocampidae	6	10	13
Saturnidae	1	1	1
Endromidae	0	1	1
Drepanidae	5	5	7
Thyatiridae	9	9	9
Geometridae	203	247	310
Sphingidae	11	17	23
Notodontidae	17	20	27
Lymantriidae	6	9	11
Arctiidae	19	24	35
Nolidae	3	4	5
Noctuidae	227	281	416

In the course of his nine reviews between 1960 and 1977, de Worms recorded a further 21 species of macro moths but excluded the micros from his survey. For 1980-86, records of micros (including the Psychidae) stand at 647 species; giving a total of 1173 moths of all species known to be presently occurring, or of recent occurrence, in the London Area.

Some of the new maps are already fairly significant in indicating the distribution of the more common species, but it is evident from the table that some moths may have been lost from the Area, or are awaiting rediscovery. It is too early to comment in detail on any of the less common or less well distributed species, particularly as it is possible for a species to be rare and yet widespread, or for one which is locally common to have a restricted distribution. For example, the chalk carpet Scotopteryx bipunctaria is abundant where it occurs, but is restricted to the North Downs in Surrey and Kent and at Grays chalk quarry in Essex. By contrast, my only records of the dark spectacle Abrostola trigemina are from the urban areas of Dulwich and Islington. Mr Jeremy Burge runs a 125-watt mercury vapour lamp trap in his garden in Fulham and has produced a species list which is remarkable for a residential area. My former garden at East Ham might have been expected to produce a much larger list, as it was adjacent to the then derelict land beside the Royal Docks in Newham and close to the tidal Roding with its extensive reed beds and other, often maritime, plants. Yet the totals, corrected for the same five-year period and using identical trapping methods, are closely similar. But such marshland species as the southern wainscot Mythimna straminea, the obscure wainscot M. obsoleta and the bulrush wainscot Nonagria typhae present at East Ham are absent from the Fulham list; whilst the autumnal rustic Paradiarsia glareosa occurs at Fulham but not at East Ham.

Analyses of immigrant moths are incomplete, but it is true that around five times as many are recorded south of the Thames as north of it. I am sure this is not for want of light traps, but of course we can always do with some more and I shall be pleased to hear from any member starting one; as indeed I shall be delighted to have earlier records from any who have not yet sent them. The survey will run to the end of 1990 and then I hope to write up the records for publication. Contributors are invited to use either the standard L.N.H.S. recording sheets or a special macro recording sheet available from me at 14 West Road, Bishops Stortford, Herts, CM23 3QP.

Entomology in the Seventeenth Century

> "Once in Nuremburg on the eleventh of August, three live larks were brought to me, which I killed. Three hours later, when I wanted to pluck them, there were seventeen thick maggots, although I had covered them immediately so that nothing could get at them. These maggots had no feet but could still hold on fast to the feathers. The next day they changed into brown 'eggs'. On 26th August there emerged a similar number of beautiful blue and green flies which I had great difficulty in catching because they moved so quickly. I caught only five of them; the others all flew away".

Thus wrote Maria Sibylla Merian in her manuscript book of "notes and studies" in about 1680. Shortly after her death in 1717 it was taken to St Petersburg, now Leningrad; but apparently not published until 1976, when it appeared in a limited edition (probably very expensive, to judge by the quality of the plates).

My translation (above) of the German text came to mind as I attended the recent lecture by Dr Erzinclioglu on Forensic Entomology (TLA 8: 29), and it may indeed be the earliest recorded observation of blowflies laying their eggs on a living host. From Maria Merian's accompanying drawings, the flies are identifiable as Calliphora erythrocephala and Lucilia caesar. She would have been aware of Francesco Redi's work in 1668 which disproved the theory of spontaneous generation, and she was clearly puzzled by the appearance of the larvae on the birds so soon after they were killed. There could have been no confusion with the viviparous flesh-fly Sarcophaga, which is brown or grey; of Lucilia, Chinnery (Collins 1973) has written that it is a serious pest in sheep raising areas. "The female lays her eggs in sores or cuts in the sheep's skin and the larvae develop there, eating the sheep's flesh away with alarming rapidity".

Catherine Schmitt

Perhaps the unfortunate larks had received wounds which attracted the attention of the flies. It would be of interest to know whether other readers have evidence of Calliphora erythrocephala ovipositing on a living host - Ed.

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A NATURALIST'S IMPRESSIONS OF WESTERN AUSTRALIA

October 1986 - March 1987

R. A. SOFTLY

A lecture given before the Society at Burlington House on 17th May 1988
In the Chair: Michael Wilsdon Esq., President

Climatically, the south-western corner of Australia is "Mediterranean" - rain in winter, drought in summer. But by reason of its far greater isolation it makes a fascinating contrast to the Mediterranian area more familiar to us. If the map of Australia is inverted and superimposed, latitude for latitude, on the map of West Africa, wind patterns and climates will roughly correspond: Perth is in the equivalent position of Marrakech. The Saharan and Libyan deserts, which cut off the green edges of Morocco, Algeria and Tunisia from the rest of Africa, are represented in the southern hemisphere by the Great Victoria, the Gibson and the Sandy deserts, which stretch from the Australian Bight across to the Eighty Mile Beach. But similarity stops here. Australia has no equivalent of the vast European temperate forest belt - there is nothing polewards but the cold Southern Ocean. Isolation is complete.

The trees of the south-west are evergreen without any deciduous admixture. They produce a perpetual rain of tough dead leaves which do not decay but create a dry inflammable litter, the basis for spasmodic forest fires, some of which must have been of unimaginable ferocity. I saw a trunk six feet in diameter, branchless for thirty feet, that appeared to be solid charcoal. It seemed impossible for any insect life to have survived in an area subjected to such a fire, and one imagines a pattern of continuous recolonisation. Seeds, however, have evolved to cope with fires, and even charred trees may retain live branches. To-day, such catastrophic events are minimized by a process of controlled burning before too much litter accumulates. This can on occasion blacken the sky.

Although most of the open "bush" has been destroyed - a mere one hundred years process compared to Britain's several thousand years reduction of its forest cover - in favour of a vast wheat and sheep belt, the big timber of the extreme south-west remains. It forms a fairly light canopy below which there flourishes a ground flora which in many areas riots into a mass of colours in the spring. These flowers are of many families unfamiliar to European eyes, which will recognise little more than the pea and orchid families. It is curious that this proliferation of species of flowering plants is not paralleled by a similar wealth of butterfly species, which number fewer than in Britain and for the most part have an early spring flight period.

Of skippers (Hesperiidae) there are many species, one of which has vastly extended its range with the introduction of palms. Swallowtails are largely confined to the eastern seaboard with just one, Papilio demoleus, able to colonise the whole continent; and only two other West Australians, both confined to the north beyond the desert belt. One, Papilio canopus, was common enough in Broome at 18°S. to be picked up as a road casualty. Even more common at Broome (where they complained of its larval depredations on their garden trees) was a yellow species, Catopsilia pomona. There are several other white or yellow species from the Pieridae, including our own Small White Pieris rapae. An unfortunate introduction, it flourishes in any urban development south of Capricorn, even in isolated little places in the outback. In the apparent absence of any native crucifers it seems to get by on garden nasturtium and cultivated cabbage. At the height of the flight period I was able to count up to half a dozen at a time in a garden in Perth. Of the Danaidae, Danaus chrysippus, which the Australians call the Lesser Wanderer, is another species able to cover the continent; but their Wanderer, our Monarch D. plexippus, is known in the east but in the west has managed to colonise only the city of Perth.

The Nymphalidae is poorly represented. The Painted Lady Vanessa cardui, another coloniser, has established itself also in the Perth area, but its congener the Australian Painted Lady V. kershawi is another virtually continent-wide species, distinguished by the blue centres to its row of hindwing eyespots. Junonia villida, an Indo-Australasian species, is notorious for having become Eleazar Albin's "Hampstead Eye" in Petiver's "Papilionum Britanniae" of 1717. Howarth, in his "South's British Butterflies", remarks: 'It is interesting to speculate on how it came to be recorded from such an unlikely locality - Hampstead - and at that period of leisurely travel'. However, the latest opinion appears to be that the association with Hampstead was an error, and Colin Plant, in his "Butterflies of the London Area" 1987, ignores it completely. This was the one species, among the few I saw with alleged continent-wide distribution, that I did actually encounter wherever I went - the temperate south, the arid outback of the mid-west, and in the tropics at Broome; a truly incredible range of habitats for a single species.

The Satyridae is represented by species very similar to our own Wall Brown and its relatives. The Lycaenidae, the blues and coppers, are present in great variety and several small blue species became familiar; including the Long-tailed Blue Lampides boeticus, calculated to make a lepidopterist feel at home anywhere. One of the more spectacular species, in its metallic blue, was introduced to me by an entomologist in a nature reserve near Perth where, under fallen pieces of bark at the foot of a tree bearing the mistletoe which is the foodplant, were clustered the mature night-feeding larvae; together with pupae, from some of which the brilliant butterflies had already emerged and were fluttering around the tree. I encountered another blue 'hilltopping' around the shrubs at the summit of a sand dune on the coast. This, and some others among the larger of the blues, had the very rapid and powerful flight that one associates with the Painted Lady or Red Admiral, themselves well known for 'hilltopping'.

North and east of the wheatbelt lie the outback cattle and sheep stations, until aridity makes even these uneconomic. The ranches divide the country and may be as big as an English county, but they have probably made little impact on the original landscape; any more than did the now displaced nomadic groups of the aboriginal colonisers. Hurtling along the red dirt 'roads' at 70 m.p.h., one sees fewer sheep or cows than kangaroo road casualties - bonuses for the Wedge-tailed Eagles. Here, too, spring carpets the ground with bloom and every mile along the many hundreds travelled is different from the next; sometimes subtly, sometimes dramatically, notwithstanding the almost universal flatness; with an elongated hill or isolated peak showing over the horizon like a glimpse of a scattered archipelago on an ocean voyage.

North beyond the desert lies the more mountainous region of summer tropical storms and cyclones, but the thunder showers are brief and the butterflies are in greater numbers. It was on the edge of this area that my northward journey came to an end, at Broome; not yet into Crocodile Dundee country, but the map of the distribution of the saltwater crocodile indicated that Broome was on the southern limit of its range, and indeed there were rumours of an old male lying somewhere in the mangrove creeks of Roebuck Bay. There are also mangroves much further south, but these are beyond what to a crocodile would be the inhospitable length of Eighty Mile Beach. The sparse 'roadhouses', hundreds of miles from the nearest town and probably twenty or thirty miles from the lights of the nearest cattle station, drew their quota of moths, to be seen settled around the windows. Black Widow spiders were sometimes left unmolested under the eaves and I saw one that had done well enough to produce three egg-cocoons. There was another, in Perth, that had succeeded in killing a small skink that could not break free of its snare.

THE RED SEA CORAL REEFS

LINDA PITKIN

Report of a lecture before the Society at Burlington House on 15th March 1988

The coral gardens of the Gulf of Aqaba, at the northern end of the Red Sea, are among the finest in the world. Bordered by Saudi Arabia to the east and by the Sinai desert to the west, the Gulf extends southwards for some 110 miles and for most of its length there is coral. Strong winds and treacherous currents assail the arab fishing boats inevitably drawn by the abundance and diversity of fish in these highly saline waters, reputed to be in the region of a thousand species. Below the surface, the scene is one of ceaseless activity by a wealth of life in a dazzling array of colours. Such complex marine ecosystems offer superb material for the underwater camera in the hands of a perceptive photographer, and it was soon evident that in the course of her many dives in these warm, clear waters Linda Pitkin had captured on film the very essence of the teeming life of a coral reef.

In some parts the Gulf is nearly a mile deep. Most life is in the sunlit upper layers of the sea and there the coral formations are intensely varied, with up to 200 species proliferating in this favourable habitat. Towards the south the reef is steep, forming colourful, submerged cliffs alive with fish; in shallower waters the coral may present the appearance of a uniform mat where one species has become locally dominant; whilst on the beach there are layers of fossil coral to be seen among the rocks. In the wake of storms the beach may be littered with fragments of the distinctive organ-pipe coral, the closely parallel tubes of which stand vertically in life and associate in the depths with the sea-fans, their red, branching formations - each tipped by a tiny pale pink polyp - reaching a height of perhaps two meters. Every coral species has its own distinctive structure, endlessly laying down a limestone fortress from the embrasures of which the polyps extend their tentacles at night to feed. Convoluted in some, branching and net-like in others, these formations in their vivid hues of yellow and red may be soft to the touch, horny or leathery, rigid or flexible; and are home to an abundance and variety of creatures hard to equal in any other environment.

Best known of the many voracious starfishes, the aptly-named crown-of-thorns, has not five but twelve arms and may be two feet across when mature. Covered with large red spines, it is a serious threat to the coral polyps on which it preys. Such other echinoderms as the long-spined sea urchins were seen, as were some beautiful shots of the nocturnal filter-feeding feather stars, stalkless relations of the now mostly extinct crinoids. The nudibranchs or sea slugs are predatory molluscs active at night, devouring sponges, jellyfishes and other hydroids. Most are arrayed in bizarre patterns and brilliant colours; notably one which has come to be known as the Spanish dancer, a reference to its all-red colouration and the swirling nature of its motion through the sea.

The fishes of this complex and overcrowded community have developed not only a specialised range of deceits and defences but clear and often brilliant markings and patterns by which they may be recognised by others of their kind. The bottom-dwelling scorpion fish is camouflaged to the point of near invisibility when motionless on sand or rock. The equally cryptic stone fish has dangerous spines to wound the unwary. The grotesquely inflated porcupine fish is scaleless but spiny, and although poisonous in parts is a delicacy in Japan. The colourful parrot fish is adapted to feed on the coral in the upper parts of the reef and is one of the few species in which all are female when juvenile. Another coral feeder is the butterfly fish, brightly coloured in tones of yellow and living always in close association with the reef and the protective retreats which it affords. One of the best known examples of marine symbiosis is the close relationship of the reef-dwelling clown fish with its toxic and dangerous partner, a sea anemone. The little clown must be faithful to its partner; another might devour it.

To snorkel out from the shore, through sparkling sun-warmed shallows to where the bed of the sea suddenly disappears, and to follow the stupendous coral cliffs in every shade of green and yellow as they lead you ever downward into the depths, is to be part of a silent world of intense colour and movement. At the mouths of submarine caverns you may observe the remarkable schooling behaviour of the glass fish, in which a hundred or more individuals move and change direction as one. You may note the rhythmic pumping respiration of the moray eel as it glides from its concealing crevice; or the passive, open-mouthed poses adopted by the clients of the cleaner wrasse. The passage of the giant manta ray will cast a shadow across the reef as it makes for open water, and hump-headed wrasse with strong teeth and thick fleshy lips are liable to take an uncomfortable interest in the human intruder. Such scenes await the visitor to the reef; but the achievement of a photographic record as comprehensive and competent as that shown to the Society on 15th March would be quite another matter.

A Field Meeting in Epping Forest

It has been a poor year so far - at least, from the lepidopterist's viewpoint - but five members met on the evening of 25th June at Epping Forest Conservation Centre, High Beach, in the hope of finding the noctuid moth Mythimna pudorina, the striped wainscot. In Essex this species is almost exclusively coastal and the only recent record from the LNHS recording area is of one at Long Running, Epping Forest, in 1984. Poor ground conditions and a blocked ride caused us to abandon the attempt to reach Long Running, and Sunshine Plain was chosen instead. As we approached this area of boggy grass and birch scrub, clouds of small moths were disturbed from the rushes, including Glyphipterix thrasonella and Cochylis nana, the tortrix Olethreutes lacunana and another tortrix, Bactra lancealana. Branches of oak trees, if knocked, yielded quantities of the green oak tortrix, T. viridana. Gold swifts, Hepialus hecta, the larvae of which feed on bracken, were hovering over the grass tussocks as darkness fell. Two generator-operated M.V. traps were set up but the catch was low, only some 24 common species being recorded by midnight. However.... in the trap were twenty pudorina. Laden with equipment, and feeling well pleased, we walked back across the dark plain by the light of a Tilley lamp; and were confirmed in our belief that pudorina is resident in the Forest by finding a pair on a grass stem in copula. Colin Plant.

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THE NEWSLETTER OF THE LNHS ECOLOGY & ENTOMOLOGY SECTION — No.11 September 1988

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THE LIFE AND WORK OF F. W. FROHAWK

Dr. JUNE CHATFIELD
The Gilbert White Museum, Selborne

A lecture given before the Society at Burlington House on 26th July, 1988

In the Chair: R.V.Goulding Esq.

The naturalist and zoological illustrator F. W. Frohawk was born at Brisley Hall in Norfolk in 1861. His early childhood was spent in East Anglia but in 1873 the family moved to Surrey. Frohawk was to spend most of the rest of his life in the London area; at Croydon, Upper Norwood, New Cross, Balham, Beckenham, Wallington and Sutton.

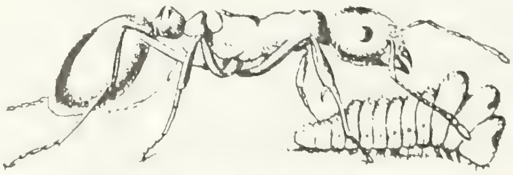
Living within easy reach of London, Frohawk had the advantage of attending meetings of the London based societies and of making frequent visits to the British Museum, the London Zoo and the many exhibitions at the Crystal Palace. He was self-taught in both art and natural history, and as a young man developed his skill and a feeling for living animals by regularly sketching at the Zoo. His early paintings were in oils and one, of the woods at Addington, is now in the National Museum of Wales in Cardiff. He was nineteen when his first oil painting, a pair of lions, was sold for ten guineas at an exhibition in the Town Hall, South Norwood. His change of medium from oils was related to commissioned work for book illustration, the mainstay of his later career.

In 1881 Frohawk became zoological illustrator for The Field on the death of T.W.Wood, with whose family he was friendly, often visiting them at Chatham and taking long country walks with Wood's brother, John. The first illustrations for The Field were drawings on wood blocks cut by the newspaper's own block-cutter, leading to a steady and increasing income as more pictures were requested. In 1884 the family met with financial disaster and from then on Frohawk found himself under heavy pressure, taking on as much commissioned work as possible, and working very long hours in support of his elderly mother, two sisters and a brother. Work for The Field was to continue for many years as Frohawk broadened out into editing and writing feature articles for the Naturalist column, initially helping the editor W.B.Tegetmeir, but as full editor on Tegetmeir's retirement. From 1891 Frohawk used a new technique of crayon on textured coated paper which provided some striking illustrations. In 1898 the development of photographic processes in printing enabled the use of monochrome watercolour wash and pencil drawings.

Much of Frohawk's output for book illustration was of birds or mammals, and as a Victorian naturalist he had a broad knowledge of his subject. His own particular interest was in the Lepidoptera and he is best known to-day for elucidating the astonishing life cycle of the Large Blue and for his books on British butterflies: 'Natural History of British Butterflies' (two volumes, 1924), 'The Complete Book of British Butterflies' (1934) and 'Varieties of British Butterflies'(1938). The first was an ambitious project of twenty years duration, in which he reared all the British species, illustrating the various stages from life and writing a text closely supported by personal observation. These books were produced during the latter half of Frohawk's life - he was sixty-three when the first was published. The original paintings for two of the books still exist but those for 'The Complete Book of British Butterflies', along with the publisher's entire stock of the book, were lost during an air-raid in World War II.

Frohawk's interest in insects dated back to earliest childhood, but it was not until he was about twenty that he met other entomologists through Dr A.G.Butler, Keeper of Entomology at the British Museum. He became a friend of Richard South and was an active member of the South London Entomological and Natural History Society, serving on Council; but he resigned during J.W.Tutt's presidency and significantly did not rejoin until after Tutt had died. Frohawk served also on the editorial board of *The Entomologist*, to which he was a regular contributor. These articles, together with those in *The Field*, appeared over a period of sixty years and are well worth scanning, particularly as they include many early records of insects in the London area. His important papers on the Large Blue appeared in *The Entomologist* for 1906 and in the *Transactions* of the Entomological Society of London for 1915-16.

Lord Rothschild purchased the butterfly collection made by Frohawk and this is now incorporated in the Rothschild Collection in the British Museum (Natural History). Frohawk later built up other collections and various specimens were given away. Those given to Lord Bolingbroke are now in the National Museum of Wales. Frohawk saw many changes in the world around him: the expansion of London, the development of the suburbs, the destruction of familiar haunts once rich in natural history. He recorded natterjack toads on Tooting Common, and his list of the breeding birds of the Common was published in 1894. His interest in natural history never left him and whilst staying in Galloway when over eighty he took note of the differences in the flora and fauna between north and south, and delighted in the sight of that northern speciality, the Scotch Argus. Wartime conditions and the destruction of the artwork for a future book on birds, together with declining eyesight, brought an end to an illustrious career; but Frohawk continued to paint for pleasure - landscapes, plant studies and natural history birthday cards for his family. He died at Sutton in December 1946 and is buried at Headley, Surrey, where his wooden grave cross bears a carving of the Camberwell Beauty. Frederick William Frohawk, a Londoner for much of his life, was one of the last of the great Victorian naturalists.



Further reading: *F.W.Frohawk; his life and work*. June Chatfield. The Crowood Press, Marlborough, 1987. Reviewed in *The London Naturalist* 66:22. Also, *I Remember*, by Valezina Bolingbroke. Feather Books, Shrewsbury, 1988. (Available from The Gilbert White Museum, The Wakes, Selborne, Hampshire GU34 3JH. £16.95, £2.50).
Illustrations by courtesy of Lady Bolingbroke and the Crowood Press.

STORM DAMAGE IN THE ROYAL PARKS

The Department of the Environment has provided some interesting statistics on the great October, 1987 storm as it affected the Royal Parks. Over 3000 trees were brought down in the storm and nearly 1000 others were so badly damaged that they were felled later. This amounted to an estimated overall loss of 2.7%; but the path of the storm was erratic and the losses in Hyde Park, Kensington Gardens, Regent's Park and Greenwich Park were at least 8.5%, and in Hampton Court and Bushy Parks an estimated 10%. By contrast, in Green Park and St James's Park the losses were limited to some 60 trees, amounting to less than 4%. Although Richmond Park - with many more trees than all the other Royal Parks put together - lost over 1000, this represented a mere 1% of its total. Most of the trees brought down in all the parks were mature, perhaps a hundred years old or more. Damage in two plantations of about this age in Richmond Park, namely Gibbett Wood and White Lodge Plantation, was as high as 20% - 25% and therefore much more intense than that affecting the park as a whole. Severe damage to the chestnut avenues in Hampton Court and Bushy Parks, the complete loss of two avenues of plane in the grounds of the the Royal Naval College, Greenwich Park, and the total loss of the famous Jubilee Avenue in Kensington Gardens were among the more catastrophic effects; and all the parks suffered grievous losses of rare specimen trees. Many trees have become exposed by the loss of others which provided shelter, and will be more vulnerable to storms and high winds for some years to come. Bats, squirrels and many nesting birds have been displaced in some of the parks, and the reduction in such insect habitats as the fissured bark associated with older trees may be locally detrimental to treecreepers and nuthatches. On the positive side, there are now possibilities for informed planting to restore historical features which over the years had become obscured or lost.

We meet the Quekett

We were pleased to welcome members of the old-established, London-based Quekett Microscopical Club to join us for an interesting and enjoyable day at Bookham on 21st May. Microscopes were set up in the Society's hut on the Common, and the morning was spent in visiting most of the ponds and collecting samples for examination.

The brown hydra is no stranger to pond dippers, but loses none of its interest with renewed acquaintance. A voracious coelenterate, one of the few fresh-water representatives of a large, mainly marine phylum, Hydra vulgaris appeared in our catch; together with one example of the less frequent H. oligactis, easily recognised by its waving, extended tentacles being at least three times the body length. Our samples also contained one of the most remarkable of all the many species of rotifers: the case-dwelling Floscularia ringens. Free-swimming rotifers of at least five species were present, but Floscularia when adult is non-motile and lives permanently in a tube attached to submerged vegetation. This tube is some 3mm in length, composed of tiny particles of solid matter placed like bricks to form a miniscule tower, the granular composition of which may clearly be seen. If undisturbed and free from vibration, Floscularia will pop up like a tiny jack-in-the-box from its concealing tube, and two groups of cilia will be set in rapid motion to direct a food-bearing vortex towards the mouth, having the appearance under the microscope of two fast-rotating wheels.

We are all so used to most animals and plants being bilaterally symmetrical that the first sight of the armoured dinoflagellate Ceratium is likely to induce some degree of surprise. Typically, the 'body' of this organism is drawn out to form four long, glass-like horns of unequal length and uneven disposition, but the Bookham examples appeared to have three such horns. The 'body' was bisected by a slanting, transverse furrow, forming a receptacle for one of the two long flagellae, and the 'armour' (a cellulose envelope) had the appearance of crinkled, interlocking, glassy plates. Movement was either in the direction of one or other of the two longer horns, or slow rotation about a central axis. Small wonder that originally this striking organism was thought to be a protozoan, especially as it has a bright red eye. Single-celled it certainly is, but the contents of the cell are green, and if Ceratium is present in the plankton of lakes and ponds in sufficient numbers the water will appear coloured. Nowadays, *Ceratium* is firmly placed in the *Dinophyceae*: motile unicellular, photosynthesising algae. What size is this shining jewel on a black velvet background? What size is a single segment of a daphnia's moulted, hollow, transparent antenna case? Big enough to hold an entrapped *Ceratium*, which seemed quite unable to break free.

Directions for making hand nets for the capture of microscopic forms of aquatic life are easily found in books - but the material for the net is not to be bought in shops; even the finest domestic fabrics appear as sheep fencing when seen under the microscope. A mesh of between 100 and 120 threads to the centimetre is required, and is to be found in the 'silk' screens used by printers. Now of nylon or polyester, it may be obtained from E.T.Marler, Deer Park Road, Morden, Surrey (01-540 8531); minimum length one metre, 41 inches wide.

A field meeting in Surrey.

The Silver-spotted Skipper *Hesperia comma* is in large measure dependent for its survival on the grass *Festuca ovina*, and is now restricted in the London area to a few sites on the chalk between Leatherhead and Reigate. Members attending our field meeting on 6th August, led by Alan Wheeler, were hopeful of being able to confirm its continued presence; and certainly the weather was highly favourable for our purpose, it being a very warm day of unbroken sunshine. By way of secret, steep and shady paths beneath ancient yews and tangled birches we ascended the downs above Betchworth. The strap-like fronds of hart's-tongue ferns caught the sunlight as it filtered through the tall beeches to where they grew in dark green drifts, and as we gained the open hillside we found the path to be bordered often by the exquisite golden flowers of the rock-rose. Less welcome was a vigorous growth of thorn scrub, threatening to invade the areas of short downland grass, bright with scabious, orchids and other flowers. Pushing through the scrub, we found ourselves in a grassy clearing fully open to the sun, and here *Hesperia comma* was frequent: pairs flying together in courtship, or settling on the flowering heads of thistles and knapweeds. Such was the heat of the day that the lady members of our party were lightly clad and a white, bare shoulder attracted a male *H. comma* which, by remaining there motionless for perhaps a minute, enabled everyone to enjoy a close view - something we found to be quite difficult when these small and unobtrusive butterflies were skipping from flower to flower, seldom staying more than a moment. Alan's intimate knowledge of this singularly unfrequented stretch of downland brought us to two other sites where *H. comma* was found to be present in good numbers, sometimes in the company of Six-spot Burnets. Geoff Chapman and Bob Young, in their book on Box Hill (1979), said "it was a disappointment to us never to record the Marbled White on Box Hill". The downs above Betchworth and the much more busy Box Hill are alike in sharing the famous view of the Weald spread out below as far as the eye may see. But the Betchworth downs still have their Marbled Whites, as we were able to confirm when a pair abandoned the waving flower heads to set off in mazy courtship flight above a sun-drenched slope.

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THE NEWSLETTER OF THE LNHS ECOLOGY & ENTOMOLOGY SECTION — No.12 November 1988

BRITISH MUSEUM
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COPPICING FOR CONSERVATION

P.H.STERLING
Department of Zoology, University of Oxford

A lecture given at the Fifth Annual Joint Meeting of the LNHS and the BENHS at Burlington House on 8th September 1988

In the Chair: R.M.Burton Esq., M.A., F.L.S.

Most of the ancient woods in this country have been managed on a coppice rotation for the past 1000 years. The underwood was cut every 10-15 years to produce logs and fence-posts, whilst standards were allowed to grow for about 70 years before being cut and used in building. Coppicing started to decline as a traditional technique at the end of the last century and especially after the second world war, with the result that most of our woods now contain areas of neglected coppice. The link of coppicing with conservation stems from the antiquity of the technique and the evidence, such as there is, that much of our woodland wildlife has declined since the practice became uneconomical. Our wildlife is thought to have become dependent upon coppicing for its survival, and that if it disappears then wild flowers, birds and insects will decline too. This has led to claims that neglected woodlands are poor in wildlife.

Does the evidence we have support the value we currently place on coppicing? The answer depends on the particular group of organisms in which you are interested. The most obvious beneficiaries are the ground-dwelling vascular plants, such as the primrose, oxlip, wood anemone and wood spurge. In the early years after cutting, these species all tend to flower more profusely and set more seed. In the later stages, plant numbers may diminish somewhat and reproduction is usually vegetative.

The picture for invertebrates is poorly known. Those species which do show benefit are light-loving species and those dependent on the early floral flush, or a combination of both. Some of our open woodland butterflies come into this category, such as the heath fritillary, which in some woods in south-east England is dependent on the good growth of cow-wheat and sunny conditions created after coppicing. There have been a few studies which have looked at other groups of invertebrates, such as predatory beetles and ground living millipedes. The effect of coppicing depended on the species, but the techniques used to sample these animals were not able to distinguish an animal's activity and its abundance. It could be that a species was more commonly caught in traps in a particular age-class simply because the animals had to hunt further for food in that habitat, rather than were genuinely commoner.

There is no particular reason to suppose that neglected woodlands are poor in insects. They may be poor in showy butterflies, but other creatures may abound.

One of this country's rarest moths, *Oecophora bractella*, is presently common in a neglected stand of oak woodland in Hampshire, where the larva feeds between the bark and trunk of standing dead coppice-poles. This species, along with any others dependent on dying or dead wood, is unlikely to benefit from the constant removal of wood in a coppice cycle.

A major problem in studying invertebrates is that they are mostly small and inconspicuous, and often nocturnal. However; some invertebrates leave traces of where they have been and these markers are usually considerably bigger than the animals that made them. Such artefacts include the webs made by spiders and the tracks or mines left by larvae of some moths, flies, beetles and wasps which feed within leaves. These artefacts can be counted whether or not the animal that made them is present at the time of sampling, and the pattern in the leaf tissue left by the miner is very frequently specific to the species that made it.

These animal artefacts formed the basis of a study of invertebrates in coppiced woodland which I carried out jointly with Clive Hambler, now an ecological consultant in Oxford. We studied the leaf-miners and web-building spiders in a number of woodlands recently brought back into coppice rotation. Much of our work was concentrated on Brasenose Wood in Oxford, where we chose a consecutive run of nine age-classes, including one cut the previous winter, and a neglected block not cut for 40 years. Leaf-mines were counted and identified (to species mostly), examining either a set number of leaves or particular heights on each stool. Spider webs were first highlighted by misting them with a water sprayer before counting and dividing them into orb, sheet and scaffold spinning species. The results were all relatively simple to explain: the numbers of nearly all species of leaf miner and all web types increased as the age of the coppice block increased, and the neglected block always had large numbers of these animals, and sometimes had the most. Woodland specialist spiders, such as *Cyclosa conica*, were always more abundant in older and neglected blocks.

We repeated the study in other woods in Oxfordshire, and on hawthorn in Brasenose Wood, and obtained similar results. We also repeated the study on leaf-miners in Bradfield Woods in Suffolk, where regular coppicing has been carried on for centuries. No species was found to benefit from the early age-classes. Whenever we looked at the canopy of older bushes for miners we always found large numbers, suggesting that height is no barrier to these tiny creatures.

In summary, coppicing is not generally a good management technique for invertebrates, but specifically creates an open woodland habitat in which some species thrive whilst others decline. Species dependent on the early flush of ground flora, such as some of our butterflies, are likely to flourish, whilst dead wood invertebrates, arboreal leaf-mining moths and web-building spiders will not. The value of re-coppicing neglected woodland must depend on what is already there, and what is likely to benefit or suffer from it. Re-coppicing is, after all, only one management option; conversion to high forest is another. Our most threatened woodland invertebrates are those dependent on living and dead wood, the very habitat that coppicing cuts down so regularly.

Further reading: Peterken, G.F. *Woodland Conservation and Management*. Chapman & Hall 1981. Sterling, P.H. and Hambler, C. Coppicing for Conservation - do hazel communities benefit? In: *Research and Survey in Nature Conservation 15*. Nature Conservancy Council 1988. Plant, C.W. *The Butterflies of the London Area*. The London Natural History Society 1987.

FIELD MEETINGS

A summer walk in the Chilterns

The heights of Pitstone and Ivinghoe, midway between Tring and Whipsnade, are of Cretacious chalk and support a rich flora and fauna. Close on 3000 acres of these famous Chiltern hills are now owned and managed by the National Trust, and are crossed by an ancient trackway, known as the Ridgeway, from which fine views may be enjoyed to the north and west. Our field meeting on 16th July, led by Richard Goulding, was attended by members of all the LNHS sections and this pooling of skills led to an excellent tally of plants, invertebrates and birds by the end of the day. The long list of 103 plants is given in the order in which they were noted during the walk:

Field Speedwell
Pineapple Mayweed
Scentless Mayweed
Shepherd's Purse
Hedge Mustard
Smooth Sow-thistle
Prickly Sow-thistle
Hop Trefoil
Creeping Thistle
Common Knotweed
Basil
White Clover
Red Clover
Herb Robert
Herb Benet
White Bryony
Black Bryony
Spear Thistle
Germander Speedwell
Scarlet Pimpernel
Meadow Foxtail
Cocksfoot
Perennial Rye Grass
Persicaria
Alcide
Common Chickweed
Field Pansy
Narrow-leaved Dock
Silverweed
Elder
Cleavers
Hedge Woundwort
Common Hogweed
Hedge Bedstraw
Common Toadflax
Woody Nightshade
Upright Hedge Parsley
Perforate St.John's Wort
Creeping Buttercup
Agrimony
Welted Thistle
White Campion
Greater Knapweed
Wild Carrot
Buckthorn
Dogwood
Common Hawkweed
Rough Hedge Parsley
Burnet Saxifrage
Rock-rose
Birdsfoot Trefoil
Goatsbeard
Dog's Mercury
Bent Knee Grass
Hazel
Field Scabious
Black Medick
Lady's Bedstraw
Common Knapweed
Yarrow
Purging Flax
Thyme
Lesser Sandwort
Veronica sp.
Musk Thistle
Ribwort Plantain
Campanula glomerata
Ragwort
Field Rose
Self-heal
Hairy St.John's Wort
Corn Sow-thistle
Woodruff
Wall Lettuce
Common Valerian
Wild Strawberry
Harebell
Wood Bardley
Enchanter's Nightshade
Catsear
Yellow Birdsnest
Wild Parsnip
Dropwort
Felwort
Wood Broam
Milkwort
Field Forget-me-not
Rosebay Willowherb
Wild Raspberry
Squinancywort
Eyebright
Crested Dog's-tail
Harebell
Clustered Bellflower
Stemless Thistle
Kidney Vetch
Devilsbit Scabious
Quaking Grass
Grey Sedge
Ox-eye Daisy
Smooth Rest-harrow
Prickly Rest-harrow
Pyramidal Orchid

Butterflies were frequent, including the always welcome Ringlet and Marbled White in a total of eight species. Fifteen other insects included the predatory beetle Heteroma merioptera, the wasp mimic beetle Clytus arietus, the toxic larvae of the Cinnabar moth feeding prominently on ragwort, and adults of Five-spot and Six-spot Burnets on flowers and grass stems. The small day-flying Geometrid moth, the Chimney Sweeper, put in a brief appearance as the party was assembling. Eight species of snails were identified, including the Kentish Snail, the Brown-lipped Snail, the Land Winkle Pomatius elegans and the uncommon Leontodon hispidus.

An introduction to Bush-Crickets and Grasshoppers

The distribution of the Rufous Grasshopper Gomphocerippus rufus in the London Area was said by R.M.Payne in LN. 37: 102-115 to be restricted to the chalk hills of Surrey and west Kent, where it favours slopes with a luxuriant growth of tall grasses. On the steep south face of Box Hill, Payne found it to be the most numerous species present. This was not our experience when we visited the site on 3rd September, for although one was eventually found in the long grass of the escarpment no others were seen. Grasshoppers and their crepuscular relatives the bush-crickets are a strangely neglected group, and very little information has been published on their frequency and distribution since Payne's review in 1957. It was hoped that our field meeting under the leadership of the Section's recorder for the Orthoptera, David Martin, might be a useful practical introduction to the group for those of us not previously versed in their ways and distinguishing features. In this it was very successful and examples of both sexes of four species were captured for examination. To realise that there is great potential in this group for interesting study one need do no more than watch under a hand lens the Dark Bush-Cricket, Pholidoptera griseoaptera, leisurely and meticulously grooming the entire length of its slender, waving antennae, at least twice as long as itself. To take a fresh look at the group, and assess the changes in status and distribution which may have occurred, David needs your observations and records of the twenty-five species of grasshoppers, bush-crickets and allied insects known in the London Area. His address is: 121 Devonshire Road, Hornchurch, Essex. The London Naturalist No.37 is now out of print; for a copy of Payne's valuable paper please write to the editorial address below.

Entomology in autumn - life in leaves

Stanmore Common is one of the former heathlands on the gravel ridges north of London and has reverted mainly to birch woodland. Across the road, on the slope of the hill, is a remarkable relict acid scrub grassland at Bentley Priory, very lightly cattle grazed, with gorse, broom, rose, bramble, sorrel and woodrush. A wooded gully leads to a lake, now a Herts and Middlesex Trust reserve. Our field meeting on 8th October assembled on a gloomy and chilly morning, but the rain held off and we were able to continue until 4 p.m. The planned activity of searching for the many kinds of leaf mines, caused principally by micro moths at this season, was one that could be conducted unhindered by the weather, and aided by the practiced eye of Col. A.M. Emmet we were able to find 54 species.

Five new county records were made: Ectoedemia heringi, a tenanted mine on Stanmore Common; Stigmella splendidissimella, tenanted mines on bramble at both localities; S. sorbi, vacated mines at Stanmore; Parornix carpinella - a species only recently recognised as distinct in Britain by Col. Emmet's investigation - vacated mine and leaf roll on hornbeam; Coleophora milvipennis in its second leaf-case on hornbeam. This is the first observation of this foodplant for this species in Britain, the usual being birch.

Several common blister-mining Phyllonorycter species were found. Those on the popular foodplant, oak, can now be distinguished by features of pupa and cocoon, the mines being often inseparable. We found tenanted and vacated mines of P. messaniella, as well as moths flying about the trees. There were larvae of the tineid moth Morophaga choragella, identifiable by their large size, in bracket fungi on logs. Ray Softly spotted a Blair's Shoulder Knot, Lithophane leautieri, on a wooden rail. I found one at light at home in Welwyn a few nights later. This rapidly spreading species feeds on the flower buds of the cypress trees that are rising everywhere in suburbia from abandoned hedges. Raymond Uffen

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THE NEWSLETTER OF THE LNHS ECOLOGY & ENTOMOLOGY SECTION — No.13 January 1989

BRITISH PLEISTOCENE BATS

Dr. ANDREW CURRANT

Department of Palaeontology, British Museum (Natural History), London

Synopsis of a lecture given at a Joint Meeting of Geology and E. & E. Sections at Holborn Central Library on 25th October 1988

Today, some 10,000 years into a major interglacial period, fifteen species of bat are considered native to Britain; it is a reasonable supposition that bats may also have formed a significant part of the British mammal fauna during previous interglacials. Such phases are relatively easy to identify in the geological record, yet until recently nothing has been known about the history of British bats in Pleistocene times. This may be due in part to their small size and the fragility of their skeletons, yet the results of extensive searching in the kinds of environment where bats may be expected to have been preserved, most notably Pleistocene cave deposits, suggest that they may have been genuinely rare and exotic members of some past faunas.

A canine tooth of a Noctule from the Freshwater Bed at West Runton, Norfolk is the sole record from the Cromerian Interglacial. Cave deposits at Westbury-sub-Mendip in Somerset have produced evidence of reindeer, a sabre-tooth cat, a hamster, voles in abundance, and our richest assemblage of Pleistocene bats; representing an as yet un-named interglacial, post-dating the Cromerian but older than the Hoxnian. Serotine, Long-eared, Barbastelle, Bechstein's, Natterer's and Geoffroy's bats are all represented at Westbury and some were abundant. The record of Geoffroy's bat, Myotis emarginatus, is particularly interesting as this is not one of our existing natives. Later records are very few in number. Two Serotine teeth have been found in what may be a Hoxnian fluviatile deposit at Cudmore Grove, East Mersea in Essex, while a specifically indeterminate Myotis molar from Minchin Hole, West Glamorgan may be the sole record from the Ipswichian Interglacial.

The total absence of fossils representing the classic cave dwellers - the horseshoe bats, Rhinolophus - is one of the many puzzling features of this patchy record, but it may be significant that they also appear to be absent from the Holocene subfossil assemblages. It could be that they are comparatively recent members of the modern British fauna, already on the wane in this marginal outpost of their European range. Examination of subfossil records shows other changes in our bat fauna that have taken place during the present interglacial, most notably the previous abundance of the now rare Bechstein's bat, Myotis bechsteini. From the evidence at Westbury, where the Pleistocene record is perhaps half a million years old, from the more recent deposits in a disused Kentish Rag quarry at Ightham in Kent, and from other Holocene sites in Norfolk and Derbyshire, bechsteini was clearly the dominant woodland bat during several phases in southern Britain.

WILD AMERICA - A NATURALIST AT LARGE

Dr. PETER GASSON

Jodrell Laboratory, Royal Botanic Gardens, Kew, Surrey

A lecture given before the Society at Burlington House on 22nd November, 1988

The United States, with an area of 3.6 million square miles, still has vast tracts of country hardly influenced by man. It is forty times larger than mainland Britain but has only four times our population; and has half the population of Europe although twice its size. For six weeks in May and June 1987 I visited botanical institutions in Pennsylvania, North Carolina, Wisconsin and Miami. I then flew to San Francisco and drove to Yellowstone National Park by way of Truckie, Wells, Idaho Falls, Craters of the Moon, Alpine, Jackson, the Grand Tetons; and back via Brigham City, Salt Lake City, Tonopah and Yosemite, reaching Monterey on the Pacific coast in mid July. In October 1988 I returned to spend a week in Raleigh, North Carolina and a week in Madison, Wisconsin. My only previous visit had been to eastern Canada and the USA ten years ago in May.

Especially in Wisconsin and in the heavily forested eastern states of Pennsylvania and North Carolina, I visited places not typically explored by British visitors. North Carolina is a long way south and has a fascinating mix of trees, including Sweet Gum Liquidambar styraciflua, Tulip Tree Liriodendron tulipifera, American Beech Fagus grandifolia, Hickories Carya sp., Oaks Quercus sp., Loblolly Pine Pinus taeda, and Sassafras albidum. The ground flora is equally rich, and in addition to the many ferns the most memorable plants are the climber Smilax, which has thorns and makes the forest difficult to explore, and Poison Ivy Rhus toxicodendron. The latter is a skin irritant and the bane of local gardeners. Further north, in Pennsylvania and Wisconsin, there are no Sweet Gums but the other species are similar, with a number of oak and maple species. In places the ground is carpeted with Clubmosses, Lycopodium and related genera, and in one area we found a colony of Moccasin Flowers Cypripedium acaule.

There is a wide variety of resident and summer visiting birds. Mockingbirds are common in urban parts of North Carolina, but are rare in Wisconsin. Tufted Titmice, Carolina Chickadees, Carolina Wrens and Brown-headed Nuthatches are readily found in North Carolina but are rare or absent further north. American Robins, Catbirds and Cardinals are ubiquitous in the eastern states, although the first two move south to some extent in the fall. Some friends in Madison kindly let me use their hide in a local woodland in June, and I photographed fifteen species in five hours as they came to a small pool to drink and bathe: American Robin, Catbird, Cardinal, American Goldfinch, Black-capped Chickadee, Indigo Bunting, Field Sparrow, Song Sparrow, White-breasted Nuthatch, Northern Oriole, Downy Woodpecker, Scarlet Tanager, Red-eyed Vireo, Rose-breasted Grosbeak, and Wood Thrush. I missed the Rufous-sided Towhee and stoat which also appeared briefly. Unfortunately, in the drought of the 1988 summer, the pool dried out. The nearby Schoeneberg Marsh, which in June '87 was frequented by Ruddy Ducks and Pied-billed Grebes, almost dried out the following year and in October was fine for such waders as Long-billed Dowitchers, Lesser Golden Plovers, Pectoral Sandpipers and Peeps; but does not bode well for 1989 if there is another dry summer. Whilst I was watching these waders a Mourning Cloak (Camberwell Beauty) butterfly settled nearby, and two Monarch butterflies were seen in flight. A frequent species in the east is the Tiger Swallowtail Papilio glaucus, the larva of which feeds on the leaves of most of the common trees.

My visit to Miami, to the Fairchild Tropical Garden, was all too brief. I could have only half a day in the Everglades, just long enough to see some classic mangrove habitat, native Mahogany and Fig trees, the Spanish Moss Tillandsia sp. growing as an epiphyte, a Zebra butterfly Heliconius sp., some alligators and a couple of memorable birds: Tricoloured (Louisiana) Heron and Swallow-tailed Kite. Southern Florida is almost subtropical, with hardly any frost, even in the depth of winter, and in summer has most spectacular rain storms.

At San Francisco airport I met my parents and we drove to Yellowstone National Park, in the north west corner of Wyoming. Although quite insignificant on a general map of the USA, it is about half the size of Wales. Yellowstone is a paradise, with plentiful wild flowers typical of the Rockies, such volcanic features as geysers and hot water pools, fossil forests, large mammals and many interesting birds. It took us three days to reach the park, where we stayed for five nights. The deer (Wapiti, Moose and Mule Deer) and bison could be very closely approached. Pronghorn Antelopes were present, but less common than in Nevada and Idaho. A coyote downed a Uinta Ground Squirrel in one mouthful, and although we saw both Grizzly and Black Bears these were more distant, most sightings being through a telescope. Yellow-bellied Marmots were particularly keen crisp eaters, and Golden-mantled Ground Squirrels were popcorn gourmets, as were Least Chipmunks. Pine Squirrels seemed to keep to a more healthy diet of pine seeds. The most exciting rodents were Beavers in Grand Teton National Park, just south of Yellowstone. Two plants deserve mention: Irish Ladies Tresses Spiranthes romanzoffiana and Blue-eyed Grass Sisyrinchium idahoensis, both of which have a strange, disjunct distribution across the Atlantic. Birds included Trumpeter Swans and Audubon's Warblers nesting, Barrow's Goldeneye, White Pelican, Bald Eagle, Grey Jay and Clark's Nutcracker.

Half way back to the west coast is Brigham City, on the Great Salt Lake. Bear River Refuge, some fifteen miles away, was inundated, the lake having increased in size over the last few years. White-faced Ibises and White Pelicans were abundant only half a mile west of the town, as were many waders, especially Marbled Godwits and Wilson's Phalaropes.

The rest of our time was spent in California. A strange species in the arid east of the state is the One-leaved Pinyon Pine Pinus monophylla. All other pines have their leaves in twos, threes or fives. Other conifers of note include the Giant Redwoods Sequoiadendron giganteum of Yosemite, and Coast Redwoods Sequoia sempervirens in several places along the coastal fog belt. These are respectively the largest (in weight and volume) and the tallest tree species in the world. Point Lobos State Park and the adjacent coastline are marvellous for Sea Otters, Harbour Seals (a subspecies of our Common Seal), Brown Pelicans and a host of seabirds.

In this immense country, with so much wildlife, it is difficult to pick out the highlights; perhaps the Grizzly mother and cub in a sagebrush meadow in Yellowstone, and the magnificent scenery in the west.

EDITORIAL

With this issue The London Atalanta becomes two years of age. What has been achieved? It is to be hoped that the contents, which have included transcripts or synopses of fifteen lectures, reports of seventeen field meetings, seven reviews of fieldwork currently in progress, and two letters from members, have reflected the wide-ranging interests of E. & E. Section. By way of introduction, Issues 2 and 7 were sent to all members, but the usual method of distribution is by hand at the Society's meetings. Members having incomplete sets and wishing to fill the gaps are invited to ask for any back numbers required. We would be pleased to receive comments, suggestions and short notes for publication.

A wet day in Greenwich

The morning of Sunday 4th December was so cold and wet that I decided to bring my own participants rather than face the field trip leader's ultimate humiliation: nobody to lead! My mother, now eighty and well wrapped up, accompanied me and a young Chinese friend as we drove to the car park on Bostall Heath. I shouldn't have worried; four hardy LNHS members turned up, the rain stopped, and together we wanderered through oak woodland mixed with gorse and bramble on a gravelly soil. By stripping bark from dead logs, beating the gorse on to plastic sheeting, searching with sweepnet and seive, and grubbing among the roots of the grassy sward, more than twenty species of spiders were obtained. "They all look the same" was one comment overheard; but several of the small black money spiders seemed promising in a catch which at this season had a higher proportion of immatures than adults. Spirits rose when a large Amaurobius similis female was turned out of her bluish web under a log, and the elegant six-eyed Harpactea hombergi emerged from fallen oak leaves. Two large adults of Linyphia triangularis were found in the gorse, together with many immatures of this species and a species of Metellina.

By midday the temperature had dropped several degrees and the rain had started again. Regretfully we gave up hope of finding Cyclosa conica, the British version of the Bird-dropping Spider, known from Lesnes Abbey Wood a mile away but not recorded for the County of London in which we were standing. The suggestion of a pint at the Ship and Anchor could no longer be deferred and was accepted with alacrity, one member expressing regret that on the Society's colder and damper winter field trips the call sometimes comes later rather than earlier. After a couple of rounds and some lively conversation on taxonomy and the thirty species of flying squirrels known in S.E. Asia, our be-gumbooted and ruck-sack carrying party (4 ladies out of 7) was not raising quite the same perplexed looks as had greeted us on arrival. As the rain was unrelenting we went our separate ways, but not before agreeing that this interesting site would be worth revisiting in better weather.

Examination of the catch at home confirmed 25 spider species of ten families. Several were typical winter-mature species of the London Area, sixteen species (64%) were from one family (Linyphiidae), and one each from the other nine. One of the commonest was Macrargus rufus, quite a large linyphiid (5-6 mm) which is easy to find in grassy places everywhere in outer London in the winter. Among the more interesting finds were Labulla thoracica, at the base of a large oak, and an adult male Ero furcata (Mimetidae) in long grass. For a complete list please write to me at 80 Weston Park, N8 9TB. J. Edward Milner

A letter from David Bevan

I enjoyed reading the plant list compiled during the summer walk in the Chilterns (TLA. 12:47) as it is an area I know fairly well. I think the list conveys a good idea of the terrain covered: disturbed ground, chalk grassland, scrub, woodland etc.; and in this sense I found it most interesting. But several of the names quoted were difficult to track down. For example, "Wood Broam" I think must be Bromus ramosus, which is the special brome most frequently found in woodland, and named Hairy Brome in the B.S.B.I. "English Names of Wild Flowers", 1986. It is a common species of grass and has been given several names. "Wood Bardley" may have been the Wood Barley, Hordelymus europaeus, a very much rarer grass and certainly a nice find - if that is what it was. It does occur locally in the Chilterns, mainly in beech woods. "Alcide" is perhaps the Alsike Clover, Trifolium hybridum, a common relic of cultivation. (Letters are always welcome - Ed.)

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THE NEWSLETTER OF THE LNHS ECOLOGY & ENTOMOLOGY SECTION — No.14 March 1989

BIOLOGICAL MONITORING OF THE RIVER THAMES AND ITS TRIBUTARIES

Dr. DEREK TINSLEY

Thames Water, Waltham Cross, Hertfordshire

A lecture given before the Society at Burlington House on 17th January 1989

The quality of the water in a freshwater river can be deduced from a knowledge of the types of animals and plants which it sustains. Some groups of macroinvertebrates which live in the river bed have been found to be more sensitive to pollution than others. The presence of pollution-sensitive groups in a sample indicates good water quality, the reverse being true if only pollution-tolerant groups are present. Such unceasing monitoring of the water by the biotope ensures that even transient sources of pollution are unlikely to escape detection.

A method used routinely by biologists working for the Thames Water Authority involves calculating a biotic score, called the Biological Monitoring Working Party (BMWP) score. Suitable sampling sites are usually shallow areas of fast flowing water, where the bed of the river consists of gravel and stones. These areas are termed riffles and often support a considerable diversity and abundance of macroinvertebrates. To sample these riffle habitats it is necessary to disturb the river bed, so that substrate and organisms are washed downstream into a well-positioned hand net. The samples are then sorted and sieved, and the invertebrates identified to family.

Each invertebrate family is allocated a score in the range 1 to 10, based on its tolerance to pollution. The most pollution-tolerant group, scoring 1, are the Oligochaete worms, which may be the only invertebrates present in very poor quality water. Conversely, the most pollution-sensitive species, scoring 10, are predominantly stoneflies, mayflies and caddis flies; although some of these families (as for example the mayfly family Baetidae, which scores only 4) can be moderately tolerant of pollution. The aquatic larvae of damselflies and dragonflies score 8. The scores for the families present are added together to give a total BMWP score for the site, a high score indicating water of good quality.

Sampling of this kind at many sites throughout the catchment area has enabled the degree of purity of many of the Thames tributaries to be determined. The results may be shown to good effect by mapping sections of rivers in colours conforming to a colour key applied to five bands of BMWP scores: 0 - 15, 16 - 50, 51 - 100, 101 - 150 and 150 plus. The River Kennet, the River Ash in Hertfordshire and the Colne Brook near Staines have been identified as having particularly high BMWP scores.

A second method used frequently by water authority biologists is called the Chironomid Pupal Exuviae Technique (CPET). Genera of the dancing midge (the chironomids) living in the bed of a river are identified from their pupal skins, known as exuviae. The eggs are laid in water and the larvae pass through four instars before pupating. When the time comes for emergence, in spring, summer and early autumn, the pupa rises to the surface where the skin splits and the adult flies free. The pupal skins remain floating for some time and are moved by river flow and wind a short distance downstream. Many become trapped by vegetation or obstacles such as locks and weirs, and can be collected at such places by simply skimming the surface scum with a fine-meshed hand net. Skins are identified with the help of a low power microscope (x100) and a taxonomic key entitled 'A practical key to the genera of pupal exuviae of the British Chironomidae' by R. S. Wilson and J. D. McGill. In addition to the taxonomy, this key indicates whether or not a species is tolerant of pollution. For each sample, the percentage of intolerant taxa is calculated. The higher this percentage, the better the quality of the water. A bar chart indicating the derived percentages of intolerant taxa at sites along the freshwater Thames was shown during the lecture.

The main advantage of the CPET over the BMWP score method is that it enables comparisons to be made between water quality at different sites along a river regardless of changes in substrate or habitat type. A disadvantage is that identification of the chironomid taxa can be more time consuming than the evaluation of macroinvertebrate families.

Sampling macroinvertebrates in the Colne Brook near Wraysbury Station

A sequel field meeting on Saturday, 28th January

A party of sixteen members of the LNHS and of the Quekett Microscopical Club took advantage of this opportunity to sample invertebrates from the bed of the Colne Brook and to identify the families present. The Colne Brook is here easily accessible and has good riffles which are rich in macroinvertebrates. After watching a demonstration of the sampling technique, given by Thames Water biologists Myles Thomas and Derek Tinsley, we were able to wade into the fast running shallows and collect samples for ourselves.

Fine-meshed nets, not unlike shrimping nets in shape, were applied to the river bed and placed so that organisms disturbed from their retreats by the feet of the operator would be swept into them by the flow of water. Under grey skies and with a light but persistent drizzle, sampling proceeded for an hour or more before we transferred to Thames Water's nearby Wraysbury Laboratories to sort and identify the catch. In this we were aided by stereo microscopes and video equipment, enabling specimens to be seen alive and much enlarged on a monitor screen. Excellent taxonomic keys were made available to us, notably 'A key to the major groups of British Freshwater Invertebrates' by P. S. Croft, and with the aid of much appreciated expert guidance we were able to contribute to the identification of the following nineteen invertebrate families:

Family	BMWP score		BMWP score
Ephemeridae	10	Baetidae	4
Leptoceridae	10	Sialidae	4
Rhyacophilidae	7	Lymnaeidae	3
Ancylidae	6	Sphaeriidae	3
Gammaridae	6	Glossiphonidae	3
Dytiscidae	5	Erpobdellidae	3
Elmidae	5	Asellidae	3
Hydropsychidae	5	Chironomidae	2
Simuliidae	5	Oligochaeta	1
Planariidae	5		
		Total site score:	90

The total site score was thus lower than a previous score of 127 obtained here by Thames Water's biologists in July, 1988; but a score of 90 still indicates that water quality is good in the Colne Brook. Of even smaller life forms, the following rotifers were identified by Mr Eric Hollowday:

MONOGONONTA:
Brachionus angularis
Brachionus calyciflorus
Keratella cochlearis
Keratella quadrata
Keratella testudo
Notholca squamula
Euchlanis dilatata
Mytilina sp.
Colurella adriatica
Lecane bulla
Proales theodora
Pleurotrocha petromyzon
Cephalodella auriculata
Synchaeta oblonga
Synchaeta pectinata
Synchaeta tremula
Polyarthra dolichoptera
Asplanchna priodonta
Filinia longiseta
DIGONONTA: Philodina sp.

Little has been recorded of the rotifer fauna of our rivers, but the presence of a number of species more typically found in the plankton of still water may indicate ingress upstream from many of the standing waters which lie along the course of the Colne Brook. Most are associated with unpolluted waters with good levels of dissolved oxygen and are therefore a further indication of the condition of the river at Wraysbury. Motile forms of microscopic algae present included *Pandorina* and *Eudorina*; together with the bright green desmid *Closterium* and the star-formed diatom *Asterionella*.

We accord our grateful thanks to the staff at Wraysbury for allowing us the use of their well equipped laboratory and for kindly providing our party with refreshments; and to Mr. E.D.Hollowday for his drawing of *Euchlanis dilatata* (x200); from *Freshwater Microscopy* by W.J.Garnett. Constable, London, 1953.

THE NATURAL HISTORY OF THE SOUTHERN HEATHLANDS

Dr. NIGEL WEBB

The Institute of Terrestrial Ecology, Furzebrook, Dorset

A lecture given before the Society at Burlington House on 21st February, 1989

Originally the word 'heath' was used to describe poor land which was difficult to cultivate, but botanists have restricted this term to the characteristic dwarf shrub vegetation which occurs on poor soils in many parts of north-west Europe. This vegetation is characterised by the dominance of small evergreen shrubs from the family Ericaceae. The conditions needed for the formation of heathland are similar to those of the dominant plant Common Heather or ling, *Calluna vulgaris*, and the occurrence of these conditions indicates the regions where heathlands can form. *Calluna* requires soils with low levels of plant nutrients and a pH in the range 3.5 - 6.7; an oceanic climate with cool, moist summers and warm, wet winters; protection by snow from low temperatures at high altitudes and adequate illumination. Heathland is generally regarded as a plagioclimax and there must be a factor which prevents succession to scrub and woodland.

Most heaths developed following the clearance of forests by man which began in the Bronze Age (3500 BC). The forest was prevented from regenerating through the use of the land for grazing, turf and peat cutting, and fuel gathering. On all the European heathlands there are well documented practices which maintained the open landscape. Heaths in Europe have been considerably reduced in extent during the last century, but extensive areas remain in Brittany, Belgium, the Netherlands, Germany, Denmark and the southern coastal areas of Sweden and Norway. In a few instances heath vegetation is maintained by exposure.

In Britain we can distinguish between upland dwarf shrub vegetation growing in organic (peat) soils frequently called moorland, and that in the lowlands growing in mineral soils and called heathland. This is not a strict definition and botanists usually employ the term 'heathland' for both types. Heathland is scattered throughout the lowlands of Britain on suitable soils. On the Isles of Scilly and the coasts of Cornwall heath is a type of climax vegetation because exposure prevents the establishment of trees. Other principal areas of heathland are the east Devon commons near Exmouth, the heaths of Dorset and the New Forest, north Hampshire, Surrey and Ashdown Forest in the Weald. In East Anglia heath occurs in the Breckland - a very special area where glaciation has resulted in complex soil formations. Heaths also occur in the Sandlings in Suffolk from Ipswich northwards along the coast and on glacial sands in Lincolnshire. Scattered fragments of heaths occur in the Midlands and there are some fine areas in the Vale of York. Elsewhere, heath can be found in scattered coastal localities, particularly on the west coasts of Scotland.

The commonest member of the Ericaceae on British heaths is Ling, *Calluna vulgaris*, which occurs almost everywhere and in some instances is almost the only species. It grows under a wide range of soil moistures. Bell Heather *Erica cinerea* occurs only on dry heath, while Cross-leaved Heath *Erica tetralix* is characteristic of humid and wet heathlands. Dorset Heath *Erica cilaris* has very similar requirements to Cross-leaved Heath, but is restricted to the Purbeck heaths in Dorset and scattered localities in Devon and Cornwall. In southern Britain it is at the northern limits of its range, which extends through the heathlands of Brittany and the Atlantic coasts of France and northern Spain. The Cornish Heath *Erica vagans* is confined to the Lizard Peninsula where it grows on the distinctive soils derived from the ultra-basic Serpentine rocks.

In Britain there are regional differences in the heaths and this is reflected in the species of grasses growing on dry heathland. On the south western heaths the characteristic grass is Bristle Bent *Agrostis curtisii*; on the south eastern heaths a mixture of fescues and bents; in the Midlands, eastern and northern Britain, the Wavy-hair Grass *Deschampsia flexuosa*. Purple Moor Grass *Molinia caerulea* is characteristic of most wet heathlands. There are three species of gorse: Common Gorse *Ulex europaeus* which flowers for an extended period in the spring, and two dwarf species - Dwarf Gorse *Ulex minor*, which is predominantly eastern in distribution, and Western Gorse *Ulex gallii* which is aptly named. The dividing line passes through the Dorset heaths where all three species occur.

A wide range of other plants occurs including sundews *Drosera spp.*, bladderworts *Utricularia spp.* and butterworts *Pinguicula spp.*, all of which are insectivorous; and the spectacular Marsh Gentian *Gentiana pneumonanthe*, now sadly declined and restricted in its distribution because of changes in heath management.

Many insects and invertebrates of interest are to be found on the southern heaths, especially those species which prefer hot, sandy conditions. The characteristic butterflies and moths include the Silver-studded Blue *Plebejus argus*, Grayling *Hipparchia semele*, Emperor *Saturnia pavonia*, Fox Moth *Macrothylacia rubi*, Heath Rustic *Xestia agathina*, True-lovers Knot *Lycophotia porphyrea*, and the day-flying Beautiful Yellow Underwing *Anarta myrtilli*.

The southern heaths are renowned also for their rare vertebrates, notably Hobby, Nightjar, Woodlark and Dartford Warbler, the Smooth Snake and the Sand Lizard. Many of these species are at the northern limits of their European ranges in southern Britain and the conservation of their habitats is of vital importance.

Further reading: *Heathlands; a Natural History of Britain's Lowland Heaths.* Nigel Webb, B.Sc., Ph.D. Collins, The New Naturalist Library; London, 1986.

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THE NEWSLETTER OF THE LNHS ECOLOGY & ENTOMOLOGY SECTION — No.15 May 1989

AN ECOLOGICAL CLASSIFICATION OF ORGANISMS

PROFESSOR PHILIP GRIME
Unit of Comparative Plant Ecology
University of Sheffield

The relatively new science of ecology depends inescapably upon a much older one (taxonomy) which remains a focus for much of the activity of the London Natural History Society. Members will be fully aware, therefore, of the extent to which ecological investigations are of doubtful value if they refer to plants or animals which have not been accurately identified. Inadequate taxonomy undermines the usefulness of ecological studies mainly because it robs other scientists of the opportunity to conduct independent tests of published results.

Although taxonomy and ecology are inextricably linked it is becoming increasingly obvious that the two activities call upon rather different skills and perspectives. Taxonomy demands precision, generates a huge fund of detailed information and attaches particular importance to genetic and evolutionary relationships. Ecology, on the other hand, seeks to understand the functional relationships between organisms which live together in characteristic assemblages but may have quite diverse evolutionary origins (eg apple trees, orchard grasses, song-thrushes and earthworms).

Two additional factors complicate the relationship between taxonomy and ecology:

(1) The attributes which are most often and most reliably used to classify organisms (eg flower structure and chromosome number in higher plants) are of little value as predictors of ecological behaviour.

(2) In large and difficult taxa such as insects, mosses and fungi, the numbers of species present in some ecosystems are so overwhelming that detailed formal taxonomy cannot provide a manageable basis for ecological analysis.

Over recent years, there has been growing recognition that for ecological purposes we require an alternative system to complement that already provided by classical taxonomy. In this new system organisms will be classified according to their functional characteristics and strong emphasis will be placed upon those features which are most consistently correlated with success in particular types of habitat and failure in others. Already, numerous schemes have been put forward and functional classifications have been applied to organisms as disparate as seaweeds, phytoplankton, lizards, birds, fungi and earthworms. Perhaps the most surprising development from this research activity has been the extent to which similar criteria have been found to be useful predictors of ecology in a wide range of animals and plants.

Arguments between the various protagonists seem destined to continue for several more years before the objective - a general functional classification of all organisms - can be achieved. However, there are pressing reasons why we should proceed as rapidly as possible to such a unified system. Chief among these is the need to develop sound predictive models of the consequences of regional and global impacts of man's activities on the abundance of individual populations of animals and plants and on the functioning and sustainability of ecosystems. At present one of the most severe impediments in constructing these computer models is that we do not have a coherent basis upon which to characterize the functional biology of the organisms which inhabit even our commonest ecosystems.

In this short article it has not been possible to consider, in detail, the various ideas which are under consideration as ecologists seek to establish a unified ecological classification of organisms. However, there are signs of an emerging concensus in which many authorities recognize the usefulness of a triangular array of functional types within which a place can be found for any organism provided that we know certain basic facts about its biology. The essential features of this system can be illustrated by reference to organisms which provide familiar examples of the three extremes of functional specialization ('ephemerals', 'capitalists' and 'stress-tolerators') which occupy the respective corners of the triangular array.

1 Ephemerals (eg garden weeds, bread moulds and dung flies). These organisms exploit circumstances where high rates of resource capture are possible for short periods and the life of the individual is soon terminated by food exhaustion, predation or some other agency. Here natural selection is likely to favour rapid growth and early reproduction both of which increase the probability that sufficient offspring will be produced to maintain the population.

2 Capitalists (eg fast-growing clonal herbs, shrubs and trees, extensive wood-rotting fungi, wading birds exploiting rich estuarine mud). Despite the wide divergence in nutrition presented by these examples, all adhere to the same pattern of resource capture and utilization. In each case high rates of resource capture from an extensive area of habitat are maintained over a long period by a process of active foraging. Active foraging compensates for local patchiness within the resource mosaic, an inevitable consequence of the high rates of depletion caused by the organism and its competitors. In mobile animals, active foraging is achieved by constant locomotion and search, whereas the same process involves the attenuation and local proliferation of mycelia in fungi and in root system and leaf canopies in vascular plants. For both animals and plants, however, active foraging is a costly activity involving high rates of re-investment of energy and other captured resources. An economic metaphor is appropriate here, with biological 'capitalism' identified as a distinctive evolutionary response to the dynamic spatial patterns of stress in rich but intensively exploited habitats and substrates.

3 Stress-tolerators (eg long-lived cushion plants; long-lived species of mosses and beetles; the fungi of lichens and of the final stages of wood decay). In these various organisms, survival and reproduction often depend crucially upon the capacity of both juveniles and adults to remain viable through long periods in which resource capture is limited by absolute shortage, intervention of climate or sequestration

> in other organisms. In stress-tolerators, it is predicted that the potential growth-rates of individuals and populations will be slow and will coincide with a marked uncoupling of resource intake from growth and reproductive activity, hence permitting the accumulation of considerable internal reserves. In strong contrast with the active spatial foraging of 'capitalist' organisms, it is predicted that resource capture in the most extreme stress-tolerators will be a more passive process in which brief, infrequent and unpredictable pulses of resource are intercepted. It is well-established that 'sit and wait' mechanisms of foraging are common among the animals of continuously hostile environments but it is only relatively recently that similar phenomena have been detected in bryophytes and flowering plants of unproductive habitats.

Can such a simple system evolve into one which accommodates all of the planet's rich assortment of plants and animals? Will a unified ecological classification of organisms unlock the mysteries of ecosystem structure and function, I suspect that the answer to both these questions is "Yes and soon".

Further reading:*

SOUTHWOOD, T. R. E., 1988. Tactics, strategies and templets. *Oikos*, 52: 3-18.

GRIME, J. P., 1988. The C-S-R model of primary plant strategies - origins, implications and tests. In L. D. Gottlieb & K. S. Jain, *Plant Evolutionary Biology:* 371-393. London: Chapman & Hall.

*reprints available from the editor of *The London Atalanta.*

THE PARMENTER LECTURES

Professor J.P.Grime's article is from his address to the Society at Burlington House on 6th March, 1989 on the occasion of the third Parmenter Lecture. The first was given on 12th May, 1986 by Dr Philip Entwistle, entitled 'Hoverflies; some ecological considerations and a review of the Syrphidae in the Home Counties'. The second was by our member Ruth Day on 21st July, 1987 on her population studies of damselflies at Bookham, featured in No.5 of The London Atalanta and No.66 of The London Naturalist. The series provides an opportunity for speakers to present the latest results of their research; members and others desiring to lecture in the series in 1990 are invited to notify the Secretary of E. & E. Section, if possible before 26th July, 1989.

Leonard Parmenter (1903-1969) held many offices in the Society for no less than forty years, including the Presidency for three years from 1949. He was actively engaged in the Society's reconstruction after the war and did much to bring about the rapid growth in our membership between 1944 and 1952. A prominent member of Ornithology and Entomology Sections, Parmenter was also a founder member of Ecology Section in 1936. He is known for his many contributions to entomological and natural history journals; and particularly for his pioneering field work on the Diptera, on which he became an authority.

A Surrey field meeting on 15th April, led by Richard Goulding

The River Wey, augmented by the Tilling Bourne and Cranleigh Waters, cuts through the western extension of the North Downs at Guildford on its serpentine course towards the Thames. In the bright sunshine of a spring morning our party at first followed the river upstream, noting that the drifts of cow parsley and the trailing stems of the ivy-leaved toadflax had already been coaxed into bloom by an early spring; and that yellow iris, greater celandine and the poisonous hemlock water dropwort were fresh in leaf. A different habitat was presented by the roadside bank, where lesser celandine, white and red dead-nettles, wild arum, forgetmenots and the introduced green alkanet flowered profusely from a mass of bluebells, ground ivy and the mat-forming slender speedwell.

To the east, the Pilgrims' Way led to where the Chantry Woods ascended in varying shades of green the sunlit slopes of the downs. Here sweet chestnut, oak, beech, ash, birch, hazel, mountain ash and sycamore mingled with Scots and Corsican pines, two species of larch, silver fir and western red cedar. Secondary growth of flowering cherry, hawthorn, sloe, rhododendron and broom provided covert for pheasants and for a shy roe deer, which afforded a close if brief view before disappearing silently among the burgeoning leaves. The woods resounded to the sibilant calls of chiffchaffs and the sudden outbursts of hidden wrens, and the sunlight filtered down through breaks in the canopy to gleam on the expanding fronds of the common polypody and its larger relatives, the male fern and broad buckler fern. A variety of mosses and liverworts included the upright growing Atrichum undulatum. Search of the dappled woodland floor revealed such plants as dog's mercury, moschatel, yellow archangel and the three-veined sandwort rising from a carpet of wood anemones and dog violets. Bright golden male brimstone butterflies came and went in the sunlit clearings as they searched assiduously for mates. An early generation of the wasp mimic hoverfly Syrphus ribesii was but the forerunner of many generations which would be on the wing all summer and autumn, and until the onset of winter. Mated queens of the social bumblebees Bombus terrestris and B. lapidarius quartered low above the ground as they prospected for nest sites in holes or under stones. The defences of the ubiquitous seven-spot ladybirds and the scarab-like dor beetle would perhaps preserve them for a time from the coal tits and nuthatches which paused but briefly to deliver their spring songs as they probed among the trees.

The pinewoods and acid sandy heathland of St. Martha's Hill were home to common storksbill, parsley piert, early-flowering forgetmenots and to Montia perfoliata, the spring beauty. The persistent songs of yellowhammmers drifted in from the slopes as the party inspected the dense, dark Irish yews which had stood beside St. Martha's Chapel for a century or longer. The shining cranesbill Geranium lucidum was not yet in flower, but could be detected at the roadside by its unmistakeable appearance in early leaf. An east wind had freshened by the time we reached the chalk downland of Pewley Hill, and such butterflies as red admirals and peacocks which earlier had enjoyed the sunshine were no longer on the wing. Germander speedwell was in flower on the chalk, and both white and black bryony were growing in close proximity and could readily be compared. There had been many opportunities during the walk to contrast the flora and fauna of differing habitats, and the members would surely turn to their books on arrival home to attempt to settle the identity of a puzzling 'cockspur thorn' encountered in the Chantries: Crataegus crus-galli or C. prunifolia perhaps, or any one of a number of closely related species.

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Editor: C.B.Ashby 31 Tudor Close, Cheam, Surrey, SM3 8QT